MVI-3 | Systemic immune response and its interaction with the tumour microenvironment in predicting immunotherapy outcomes

Host unit	Main supervisor	Co-supervisor
Institute of Microbiology and Virology (MVI) Explore the host institute Immunology & Cancer group	Prof. Dace Pjanova View research profile Visit the research group	Dr Zaiga Nora-Krūkle View research profile

APPLICANT FREEDOM The topic defines a research area, not a pre-written project. Applicants may propose a distinct, original approach provided that it remains scientifically aligned with the theme and demonstrably feasible in the host environment.

Research context and rationale

The effectiveness of cancer immunotherapy is shaped by complex interactions between systemic immune responses and the tumour microenvironment. Advances in immunophenotyping, transcriptomics, single-cell technologies, and computational biology provide new opportunities to characterize immune cell states, signalling pathways, and molecular determinants of treatment response and resistance. Melanoma is the principal disease model envisaged for this research area, linking systemic immune profiling with the tumour microenvironment and immunotherapy outcomes.

Indicative scientific scope

Projects should investigate how systemic immune states interact with tumour-local immune mechanisms in treatment response or resistance. Biomarker development may be included, but the project must distinguish exploratory association from validated prediction and avoid overclaiming clinical utility.

Examples of research questions

- Which systemic and intratumoural immune-cell states are associated with response or resistance?
- How do cytokine signalling and IFN-gamma-related signatures interact across blood and tumour compartments?
- Can multi-modal immune features improve explanation or prediction beyond established clinical factors?
- Which findings can be reproduced in retrospective material or independent datasets available through approved routes?

Possible approaches

- Multiparametric flow cytometry and immunophenotyping.
- Bulk and single-cell RNA sequencing with integrative bioinformatics.
- Analysis of cytokine or immune-signalling profiles.
- Retrospective correlative analysis using clinically annotated material where access is lawfully approved.

METHODS NOTE The approaches above are indicative. Applicants should select and justify methods appropriate to their own questions rather than attempt to include every method listed.

Relevant host expertise and resources

Expertise: Tumour immunology, molecular oncology, translational cancer research, immune profiling, single-cell analysis and biomarker research.

- BD FACSDiscover S8 and FACSAria III platforms, cell culture and processing equipment, gentleMACS Octo dissociator, real-time and digital PCR and light, fluorescent and confocal microscopy.
- 10x Genomics Chromium, Agilent TapeStation and HPC/bioinformatics support.
- The host group collaborates with Riga East Clinical University Hospital/Latvian Oncology Centre. Potential research resources include clinically annotated material, archival FFPE tumour samples and relevant Latvian Genome Database resources, subject to project-specific agreements, ethical approvals and lawful access arrangements.

ACCESS CONDITION Access to the specialised resources listed above is subject to the conditions described in the separate MVI Host Profile and to project-specific arrangements.

Interdisciplinary and intersectoral opportunities

- Integration of immunology, oncology, bioinformatics, statistics and clinical expertise.
- Potential collaboration with social scientists where patient communication, behaviour or wider determinants form a justified complementary component.

Potential collaboration and secondment pathways

- Royal College of Surgeons Ireland, systems medicine, computational pathology, spatial and single-cell multi-omics, clinical biobanking and translational validation.
- Spanish National Research Council, cancer epigenomics, single-cell and multi-omic analysis, flow cytometry and immune-signature interpretation. Prof. Mario Fernández Fraga is a proposed external mentor for this research area, subject to agreement on project-specific involvement.
- National Institute of Research and Innovation, SPF rodent handling, tumour models, surgery, IVIS imaging and in vivo study design.

- SIA APPLY, applied AI, computer vision, predictive modelling and production-oriented digital-health development.

SECONDMENT STATUS Participation in a mandatory secondment of 6–12 weeks forms part of KEY-RSU. The final host, duration, objectives and outputs will be agreed for the selected fellow and aligned with the approved KEY-RSU rules and Career Development Plan. The researcher remains employed by RSU throughout the secondment. Additional host organisations may be considered, subject to confirmation of their suitability, compliance with KEY-RSU requirements and any necessary approvals.

Research training and career development

Scientific training opportunities include advanced immune profiling, flow cytometry, bulk and single-cell RNA sequencing, integrative bioinformatics, experimental design and multi-omic data analysis, according to the selected project. These are complemented by programme-level training in project management, scientific writing, grant preparation and communication. Opportunities to mentor undergraduate and master's students and contribute to guest lectures or practical teaching will depend on the researcher's experience and institutional arrangements. Individual training priorities will be agreed through the Career Development Plan.

Applicant background

Relevant background: Applicants should hold a doctoral degree and demonstrate a strong research background in immunology, cancer biology, molecular medicine, bioinformatics, biostatistics, or a related discipline. Candidates should demonstrate the ability to develop and conduct independent research, contribute to the analysis and interpretation of complex biological and clinical datasets, and integrate experimental and computational approaches where appropriate. Assessment will consider the quality, originality, and relevance of the applicant's research contributions, as well as evidence of collaboration, mentoring, supervision, knowledge sharing, and engagement with the wider research community. Experience in immunophenotyping, transcriptomics, single-cell technologies, biomarker discovery, clinical or translational research, and advanced data analysis will be considered an asset where relevant to the proposed project. Competence will be evaluated in the context of the proposed research and the applicant's overall expertise, achievements, and potential.

Competences that may strengthen the proposal

The following experience may strengthen a proposal but is not an automatic eligibility requirement:

- tumour immunology, cancer biology or molecular oncology;
- immunophenotyping or multiparametric flow cytometry;
- bulk or single-cell transcriptomic analysis;
- bioinformatics, biostatistics or integration of multimodal data;
- analysis of cytokine or immune-signalling profiles;
- translational research involving clinically annotated samples or datasets.

Applicants are not expected to demonstrate all these competences. The proposal should identify the expertise essential to the selected design and distinguish it from skills that can be developed or accessed through collaboration.

Feasibility boundaries

- Access to patient samples, FFPE material, clinical data, biobank resources, and genome database datasets is subject to the necessary ethical approvals and data access permissions.
- Proposals should include a realistic strategy for sample size, data quality, management of missing data, and validation of key findings.
- The project scope should be aligned with available sample volumes, analytical platform capacity, and allocated research resources.
- Predictive or biomarker-related claims should be supported by robust study design, appropriate statistical analysis, and independent validation where feasible.
- The proposed objectives and methodologies should be achievable within the fellowship period and the capabilities of the host research environment.

Ethics, data and responsible research

- Research involving human biological materials, health data, and clinical information must comply with all applicable ethical, legal, and data protection requirements, including appropriate approvals, lawful access, data minimisation, and secure data handling.
- Study design and data analysis should consider potential sources of bias, cohort representativeness, data quality, and the clinical relevance and interpretability of findings.
- Data management should follow FAIR principles and institutional policies, ensuring responsible collection, storage, analysis, sharing, and long-term stewardship of research data.
- Biomarker and predictive findings should be reported transparently, with appropriate assessment of uncertainty, limitations, reproducibility, and validation status, avoiding unsupported clinical claims.
- Applicants are expected to adhere to the principles of research integrity, transparency, reproducibility, and responsible conduct of research throughout the project lifecycle.

Expected contribution

The research is expected to improve understanding of systemic-tumour immune interactions and identify rigorously supported immune features relevant to immunotherapy response and resistance.