

PhD Position in Molecular and cellular aspects of biology, specialization in neuroscience

University of Caen Normandie

Brain endothelial extracellular vesicles as blood-based biomarkers for the early triage and stratification of acute stroke

Location: Caen, Normandie, France

Host laboratory: INSERM UMR-1237 – PhIND “Physiopathology and Imaging of Neurological Disorders”; Blood, Brain & Memory @ Caen Normandie institute

Start: November 2., 2026

Duration: 36 months

Funding: Fully funded PhD position (University of Caen)

Key-words: Stroke, extracellular vesicles, cerebral endothelium, biomarkers, triage and stratification.

Project summary: This project proposes an innovative and translational approach aimed at improving the early management of acute stroke through the identification of blood-based biomarkers derived from the cerebral endothelium. Current stroke triage relies predominantly on clinical assessment and neuroimaging; however, the first medical decisions are often made in the prehospital setting, when imaging is not yet available and diagnostic uncertainty remains high. Distinguishing true stroke from stroke mimics, identifying ischemic versus hemorrhagic stroke, and predicting early neurological worsening therefore remain major clinical challenges.

The project is based on the hypothesis that brain endothelial extracellular vesicles (BEEVs) reflect early alterations of the neurovascular unit and blood–brain barrier integrity occurring during acute stroke. Because extracellular vesicles carry molecular cargos representative of the physiological state of their cells of origin, BEEVs may provide accessible circulating biomarkers capable of informing on cerebral endothelial dysfunction and neurovascular injury during the earliest phases of disease. To address this question, the project combines several complementary strengths already established within the laboratory, ensuring both feasibility and strong translational potential. These include access to a well-characterized clinical biobank of acute stroke patients recruited at the Emergency Department of Caen University Hospital, expertise in extracellular vesicle isolation and characterization, and advanced human models of the blood–brain barrier derived from induced pluripotent stem cells (iPSCs).

The objectives of the project are threefold: first, to identify a specific molecular signature of BEEVs associated with stroke diagnosis and subtype discrimination, including ischemic stroke, hemorrhagic stroke, and stroke mimics; second, to validate the functional and causal relevance of these vesicles using human iPSC-derived brain microvascular endothelial models under both static and flow conditions; and third, to discover novel molecular pathways and therapeutic targets through integrated single-cell transcriptomics (scRNA-seq) and high-dimensional proteomic profiling using Olink technology. By integrating clinical cohorts, extracellular vesicle biology, advanced human neurovascular models, transcriptomics, and proteomics, this project introduces a new conceptual framework centered on endothelial plasticity in acute stroke. Ultimately, it aims to establish an early “biological stratification” of stroke patients capable of supporting prehospital decision-making, optimizing patient orientation toward specialized care pathways, and contributing to the development of precision medicine approaches in cerebrovascular diseases.



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Description of the host laboratory: Located in Caen, in the Normandy region of northwestern France, the laboratory benefits from a dynamic and attractive scientific environment within a vibrant student city combining high quality of life and strong academic activity. Caen offers immediate access to the Normandy coastline, with the sea located less than 15 minutes away, while Paris is easily reachable in approximately two hours, providing an ideal balance between research excellence, accessibility and quality of life.

The INSERM research unit “*Physiopathology and Imaging of Neurological Disorders*” (PhIND), directed by Prof. Denis Vivien, is internationally recognized for its expertise in stroke research, neurovascular biology, and imaging innovation. The unit is located at the Cyceron Center in Caen, Normandy (France), a leading multidisciplinary research environment providing state-of-the-art facilities in molecular and cellular biology, experimental surgery, and in vivo experimentation, together with a large animal facility affiliated with the University of Caen Normandy. The PhD project will be carried out within the TRANSCEND team directed by Prof. Richard Macrez and Dr. Benoit Roussel, within the PhIND unit. The team develops translational approaches in cerebrovascular diseases, with particular expertise in stroke pathophysiology, cellular and molecular biology of the neurovascular unit and biomarkers. This PhD project will be conducted under the supervision of Prof. Macrez.

In addition, the unit is affiliated with the *Blood, Brain and Memory @ Caen-Normandie (BBM@C)* institute, which provides access to several cutting-edge technological platforms, including sequencing facilities (InnovaSeq), biobanking and human sample analysis infrastructures (InnovaBIO), and advanced imaging facilities integrated within the France BioImaging network. The project will also benefit from direct access to patients and biological samples through a dedicated clinical biocollection coordinated by Prof. Richard Macrez, providing a unique translational framework linking clinical cohorts, biomarker discovery, and mechanistic experimental studies.

All the technological and material resources required for the project are already available and fully operational either within the laboratory or through local core facilities, ensuring the feasibility of the project. These resources include:

- Cell biology and iPSC culture platforms;
- Human brain microvascular endothelial cell and blood–brain barrier models under static and microfluidic flow conditions;
- Flow cytometry, advanced microscopy, TEER measurement systems, and molecular biology facilities (PCR, Western blotting);
- Access to Olink Proteomics technology, already routinely implemented within the team, enabling high-throughput proteomic analyses from very small sample volumes;
- Dedicated computational infrastructures and expertise for statistical analyses, bioinformatics, and predictive modeling.

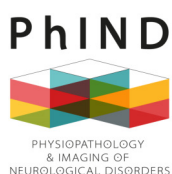
Candidate profile: The candidate must hold a Master’s degree in biology, neurobiology, neuroscience, or a related field. The candidate should demonstrate a strong interest in neurovascular biology, preclinical and translational research, and projects bridging experimental neuroscience with clinical applications. Motivation to work on stroke research will be particularly appreciated. Proficiency in either French or English is required. Prior experience with techniques relevant to the project including cell culture, flow cytometry, proteomics, transcriptomics, and statistical or bioinformatic analyses will be considered a strong asset. Experience with multidisciplinary collaborative research environments will also be appreciated

Application before July 3, 2026: Applicants must submit a CV and a cover letter as part of their application. They are also encouraged to provide a letter of recommendation.

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