Tushar Deshpande

Decoding the Neurovascular Unit: From Barrier Biology to Targeted RNA Editing

deshpande@uni-muenster.de | +49 01784494594 | Leiden, The Netherlands
https://www.linkedin.com/in/tushar-deshpande-634629b5/

Neurovascular biologist with >16 years of experience in academia and industry. Research centers on how glial, vascular, and extracellular-matrix interactions regulate brain homeostasis and disease, with emphasis on epilepsy, stroke and vascular dementia. The work integrates in vivo rodent models, microscopy and single-cell RNA sequencing to define mechanisms, identify therapeutic targets, and support targeted RNA-editing strategies.

RESEARCH AREAS

- Neurovascular unit biology, blood-brain barrier function, and barrier specialization
- Epilepsy, stroke, vascular dementia, and white matter injury
- Single-cell, bulk, spatial, proteomic, imaging, and histopathology data integration
- Astrocyte physiology, glial coupling, connexin biology, and epileptogenesis
- Vascular basement membrane biology, perivascular drainage, and immune cells
- Targeted RNA editing, oligonucleotide design and off-target assessment

EXPERIENCE

Senior Scientist and Project Leader — 2025-present

ProQR Therapeutics | Leiden, The Netherlands

Data-driven CNS and liver disease biology: Generate biological insights for RNA-editing therapeutic programs.
Mechanistic interpretation of therapeutic response: Integrate transcriptomic, target-engagement, and off-target datasets to interpret disease biology and molecular consequences of RNA-editing interventions.
Scientific leadership and mentoring: Lead and mentor junior scientists in the biological interpretation of complex datasets, ensuring that computational analyses are translated into drug-discovery decisions.
RNA-seq experimental design and interpretation: Design and interpret RNA-seq experiments for high-throughput screening, model characterization, and lead selection.
CNS therapeutic discovery: Support CNS discovery programs in epilepsy, Rett syndrome, and Alzheimer's disease by prioritizing oligonucleotide candidates & characterizing disease models.
Pathway- and network-level biological insight: Apply pathway, network, and statistical analyses to uncover disease mechanisms and guide cross-functional decisions across biology, genomics, pathology, and toxicology.
Reproducible biological data analysis: Develop reproducible analytical workflows in R, Python, Linux/HPC, and Nextflow to support rigorous biological interpretation
FAIR data management and knowledge integration: Implement FAIR data-management principles and experimental protocol tracking in Dotmatics to strengthen reproducibility, data integration, and cross-program knowledge transfer.
Investigational New Drug-supporting pharmacodynamic analysis: Contributed pharmacodynamic and biological data analyses supporting the investigational new drug application for AX-810 in cholestatic disease

Guest Scientist — 2025-present

University of Muenster | Germany

Neurovascular Transcriptomics: Continue manuscript development and biological interpretation of single-cell, spatial, and translational transcriptomics datasets focused on neurovascular biology and CNS disease mechanisms.
Doctoral mentoring in omics-driven biology: Mentor doctoral researchers in neurovascular disease biology, omics analysis, data visualization, hypothesis development, and manuscript preparation.

Post doctoral Researcher — 2017-2025

University of Muenster | Germany

Co-leadership of international neurovascular research consortia: Co-led highly collaborative multidisciplinary projects, including the EU Horizon 2020 SVDs@target consortium involving 12 laboratories across 7 countries, and DFG-funded stroke and obesity collaborations with partners in Germany and China.
Integrated platforms for CNS disease biology: Established imaging, histopathology, functional physiology, and omics workflows to investigate cerebral small vessel disease, stroke, and neurovascular unit dysfunction.

Disease-model validation for cerebral small vessel disease: Demonstrated that Notch3 mutant and hypertensive BPH/2J mice recapitulate key human small vessel disease features, including microglial activation, focal demyelination, and perivascular plasma protein leakage without substantial peripheral immune-cell infiltration.

Human neuropathology and translational disease phenotyping: Performed MRI–histopathology correlation studies on human autopsy tissue to define white matter lesion pathology and vascular abnormalities in stroke and cerebral small vessel disease.

Basement membrane mechanisms in neurovascular dysfunction: Elucidated roles of vascular basement membrane laminins in cerebral micro vessel functional zonation and stroke-related neurovascular unit outcomes.

Single-cell and bulk RNA-seq for CNS disease models: Optimized single-cell dissociation and analysis workflows for 10x Genomics and BD Rhapsody platforms and conducted integrated bulk and single-cell RNA-seq analyses in mouse models of stroke and neurovascular disease.

Public dataset reanalysis for biological discovery: Reanalyzed public single-cell RNA-seq datasets to generate mechanistic hypotheses that were experimentally validated, and applied pathway and network analyses to secretomic and extracellular-matrix studies.

Image-based vascular biology and perivascular pathway mapping: Developed quantitative imaging strategies to classify cerebral vessel types and characterize perivascular pathways, supporting mechanistic studies of clearance, barrier specialization, and inflammation.

Functional neurovascular physiology and surgical expertise: Established multimodal functional readouts, including cerebral blood-flow measurement by laser Doppler flowmetry, and obtained certification for surgical procedures on anesthetized rodents under European Union laboratory-animal regulations.

Mentoring, teaching, and academic training: Co-supervised two doctoral theses and one master's thesis, and taught image analysis and FACS/immunology practical courses to medical undergraduates and graduate learners.

Doctoral Researcher — 2012-2017

University of Bonn | Germany

Mechanistic astrocyte biology in epilepsy: Investigated molecular mechanisms of astrocyte dysfunction and astrocytic uncoupling in epilepsy using human tissue, experimental mouse models, biochemical assays, high-resolution microscopy, proteomics, and quantitative image analysis.

Quantitative human neuropathology: Automated cellular characterization in human brain tissue and identified pathological protein-distribution patterns in epilepsy specimens.

Connexin43 phosphorylation and seizure-associated remodeling: Purified the membrane protein connexin43 and identified post-seizure phosphorylation sites using mass spectrometry, providing mechanistic insight into seizure-associated astrocytic gap-junction remodeling.

Expansion microscopy of human epileptic tissue: Visualized gap junction reorganization in human brain samples using high-resolution expansion microscopy and evaluated the therapeutic potential of targeting connexins in epilepsy.

Competitive doctoral fellowship and academic distinction: Received the NRW International Graduate School BIOTECH PHARMA fellowship and completed the doctoral degree with magna cum laude distinction

Junior Scientist — 2010-2012

Dr. Reddy's Laboratories | Hyderabad, India

Translational formulation-development support: Supported novel drug-formulation development through the Centre of Excellence – Bio Studies.

Predictive modeling for pharmacokinetic performance: Instituted statistical models to predict formulation performance in vivo and performed pharmacokinetic modeling for novel formulations.

Cross-functional delivery of bioequivalence studies: Collaborated across formulation, pharmacokinetics, and translational development teams to support timely completion of bioequivalence studies and formulation-development milestones.

EDUCATION

PhD in Neuroscience — 2012-2017

University of Bonn, Germany

Dissertation: molecular mechanisms of astrocyte dysfunction in epilepsy.

Graduated magna cum laude; NRW International Graduate School BIOTECH PHARMA fellow.

M.S. in Pharmacology **2008-2010**

National Institute of Pharmaceutical Education and Research | S.A.S. Nagar, India

Thesis: Role of endothelin receptors in stroke.

Bachelor of Pharmacy **2004-2008**

Government College of Pharmacy | Aurangabad, India

Training in drug discovery, drug development, pharmacology, and pharmaceutical sciences.

SELECTED RESEARCH ACCOMPLISHMENTS

Cerebral small vessel disease and human relevance: Defined neuroinflammatory and vascular pathology signatures in mouse and human disease contexts, showing microglial activation, focal demyelination, and vascular leakage without substantial peripheral immune-cell infiltration.

Vascular basement membrane biology: Advanced understanding of how laminins and extracellular-matrix specializations modulate cerebral microvessel functional zonation and neurovascular outcomes.

Perivascular pathways and vessel classification: Developed image-based vessel-type classification strategies to resolve brain perivascular drainage pathways and support quantitative mapping of barrier and clearance mechanisms.

Astrocyte connexin biology in epilepsy: Combined human tissue analysis, mouse epilepsy models, protein purification, mass spectrometry, and expansion microscopy to identify connexin43 remodeling and phosphorylation changes linked to astrocyte uncoupling.

Translational RNA-editing analytics: Built and applied computational workflows for RNA-editing drug discovery, including transcriptomic model characterization, editing-efficiency analysis, target engagement, and in silico off-target prediction.

TEACHING, MENTORING, AND ACADEMIC SERVICE

Co-supervised two PhD theses and one Master's thesis at the University of Muenster.

Mentored junior scientists and doctoral researchers in experimental design, quantitative analysis, omics workflows, data visualization, reproducible computation, and manuscript preparation.

Delivered teaching and practical training in image analysis, FACS/immunology, microscopy, and biomedical methods for undergraduate, medical, and graduate learners.

Contributed to collaborative manuscript development, figure design, data interpretation, and cross-disciplinary coordination with clinicians, pathologists, data scientists, and experimental biologists.

German language proficiency: B1; able to contribute to international and German academic training environments.

TECHNICAL AND METHODOLOGICAL EXPERTISE

Experimental models and physiology: Rodent models of epilepsy, stroke, cerebral ischemia, and cerebral small vessel disease; surgical procedures under EU laboratory-animal regulations; laser Doppler flowmetry; cerebral blood-flow analysis; cell culture; in situ hybridization.

Imaging, histopathology, and neuropathology: Confocal microscopy, expansion microscopy, immunohistochemistry, MRI-histopathology correlation, autopsy tissue phenotyping, white-matter lesion analysis, vessel segmentation/classification, quantitative image analysis.

Omics and computational biology: Bulk RNA-seq, single-cell RNA-seq, spatial transcriptomics, proteomics, secretomics, transcriptomic reanalysis of public datasets, pathway/network analysis, multimodal integration, statistical modeling, machine learning-informed interpretation, data visualization.

RNA therapeutics and translational bioinformatics: Target engagement, editing-efficiency assessment, on-/off-target prediction for oligonucleotide drugs, high-throughput screening analysis, lead selection, pharmacodynamic analysis, liver and CNS disease-model characterization.

Reproducible infrastructure: R, Python, Linux, HPC environments, Nextflow workflows, automated reports, FAIR data management, Dotmatics protocol/data infrastructure.

Leadership and collaboration: Project management, team supervision, cross-functional collaboration, manuscript strategy, translational coordination, and mentoring across academic and biotechnology settings.

HONORS AND AWARDS

Best Presentation Award, first prize at the symposium "Signal Transduction at the BBB," Uppsala, Sweden (2023).
Young Pharmacologist Award, NIPER, Raebareli, India (2021).
NRW International Graduate School BIOTECH PHARMA Fellowship, University of Bonn (2012).

CERTIFICATIONS

Certificate for Performing Surgical Procedures on Anesthetized Mice, Animal Protection Unit, Veterinary Office, University of Muenster (2023).
AI in Medical Imaging, University of Muenster (2023).
AI Theory and Techniques for Interdisciplinary Research, University of Muenster (2021).
General Animal Experimentation Certificate, University of Muenster (2017).

LANGUAGES

English; Marathi/Hindi; German (B1)

REFERENCES:

Prof. Lydia Sorokin, Director, Institute of Physiological Chemistry and Pathobiochemistry, University of Muenster, Germany. Email: sorokin@uni-muenster.de

Prof. Christian Steinhaeuser, Senior Professor, Institute of Cellular Neurosciences, University of Bonn, Germany, Email: cste@uni-bonn.de

Prof. S.S. Sharma, HOD, Department of Pharmacology and Toxicology, National Institute of Pharmaceutical Education and Research, S.A.S Nagar, India. Email: sssharma@niper.ac.in

PUBLICATIONS

1. Hannocks, M.; Song, J.; Burmeister, M.; Gerwien, H.; Kapupara, K.; Samawar, S.; **Deshpande, T.**; Sorokin, L. Anatomy and Microanatomy of Immune Tissues Central Nervous System: Microanatomy. In Encyclopedia of Immunobiology; Academic Press, 2026; Vol. 3, pp 89-97.

2. Deshpande, T.; Kapupara, K.; Hannocks, M.-J.; Huppert, J.; Samawar, S. K. R.; Thulichery, D. R.; Budny, S.; Ghavampour, S.; Song, J.; Meng, L.; Adams, R. H.; Jeong, H.-W.; Wachsmuth, L.; Faber, C.; Soltwisch, J.; Hallmann, R.; Sorokin, L. Vascular Basement Membrane Laminins Modulate Functional Zonation of Cerebral Microvessels. Journal of Cerebral Blood Flow & Metabolism 2026. DOI: https://doi.org/10.1177/0271678X251410040

3. Shen, S.-H.; Gerwien, H.; Burmeister, M.; Tsang, Y.-L.; Lu, I.-N.; Boersch, A.-L.; **Deshpande, T.**; Sorokin, L.; Meyer zu Hoerste, G. MMP-9 Affects Dural Cell Composition and Granulocyte Accumulation during Neuroinflammation. Frontiers in Immunology 2025, 16. DOI: https://doi.org/10.3389/fimmu.2025.1713166

4. Deshpande, T.; Hannocks, M.-J.; Kapupara, K.; Samawar, S. K. R.; Wachsmuth, L.; Faber, C.; Smith, C.; Wardlaw, J.; Sorokin, L. Microglial Activation without Peripheral Immune Cell Infiltration Characterises Mouse and Human Cerebral Small Vessel Disease. Neuropathology and Applied Neurobiology 2024, 50 (6), e13015. DOI: https://doi.org/10.1111/nan.13015

5. Anders, S.; Breithausen, B.; Unichenko, P.; Herde, M. K.; Minge, D.; Abramian, A.; Behringer, C.; **Deshpande, T.**; Boehlen, A.; Domingos, C.; Henning, L.; Pitsch, J.; Kim, Y.-B.; Bedner, P.; Steinhaeuser, C.; Henneberger, C. Epileptic Activity Triggers Rapid ROCK1-Dependent Astrocyte Morphology Changes. Glia 2024, 72 (3), 643-659. DOI: https://doi.org/10.1002/glia.24495

6. Song, J.; **Deshpande, T.**; Zhang, X.; Hannocks, M.-J.; Lycke, N.; Cardell, S. L.; Sorokin, L. The Extracellular Matrix of Lymph Node Reticular Fibers Modulates Follicle Border Interactions and Germinal Center Formation. iScience 2023, 26 (5), 106753. DOI: https://doi.org/10.1016/j.isci.2023.106753

7. Burmeister, M.; Fraunenstein, A.; Kahms, M.; Arends, L.; Gerwien, H.; **Deshpande, T.**; Kuhlmann, T.; Gross, C. C.; Naik, V. N.; Wiendl, H.; Klingauf, J.; Meissner, F.; Sorokin, L. Secretomics Reveals Gelatinase Substrates at the Blood-Brain Barrier That Are Implicated in Astroglial Barrier Function. Science Advances 2023, 9 (29), eadg0686. DOI: https://doi.org/10.1126/sciadv.adg0686

8. Wu, Z.; **Deshpande, T.**; Henning, L.; Bedner, P.; Seifert, G.; Steinhaeuser, C. Cell Death of Hippocampal CA1 Astrocytes during Early Epileptogenesis. Epilepsia 2021, 62 (7), 1569-1583. DOI: https://doi.org/10.1111/epi.16910

9. Katoozi, S.; Skauli, N.; Zahl, S.; **Deshpande, T.**; Ezan, P.; Palazzo, C.; Steinhaeuser, C.; Frigeri, A.; Cohen-Salmon, M.; Ottersen, O. P.; Amiry-Moghaddam, M. Uncoupling of the Astrocyte Syncytium Differentially Affects AQP4 Isoforms. Cells 2020, 9 (2), 382. DOI: https://doi.org/10.3390/cells9020382

10. Deshpande, T.; Li, T.; Henning, L.; Wu, Z.; Mueller, J.; Seifert, G.; Steinhaeuser, C.; Bedner, P. Constitutive Deletion of Astrocytic Connexins Aggravates Kainate-Induced Epilepsy. Glia 2020, 68 (10), 2136-2147. DOI: https://doi.org/10.1002/glia.23832

11. Hannocks, M.-J.; Pizzo, M. E.; Huppert, J.; **Deshpande, T.**; Abbott, N. J.; Thorne, R. G.; Sorokin, L. Molecular Characterization of Perivascular Drainage Pathways in the Murine Brain. Journal of Cerebral Blood Flow & Metabolism 2018, 38 (4), 669-686. DOI: https://doi.org/10.1177/0271678X17749689

12. Deshpande, T.; Li, T.; Herde, M. K.; Becker, A.; Vatter, H.; Schwarz, M. K.; Henneberger, C.; Steinhaeuser, C.; Bedner, P. Subcellular Reorganization and Altered Phosphorylation of the Astrocytic Gap Junction Protein Connexin43 in Human and Experimental Temporal Lobe Epilepsy. Glia 2017, 65 (11), 1809-1820. DOI: https://doi.org/10.1002/glia.23196

13. Deshpande, T. Unravelling Mechanisms Causing Astrocytic Uncoupling in Epilepsy. Thesis, Universitaets- und Landesbibliothek Bonn, 2017. DOI/URL: https://bonndoc.ulb.uni-bonn.de/xmlui/handle/20.500.11811/7262

14. Khan, D.; Dupper, A.; **Deshpande, T.**; Graan, P. N. E. D.; Steinhaeuser, C.; Bedner, P. Experimental Febrile Seizures Impair Interastrocytic Gap Junction Coupling in Juvenile Mice. Journal of Neuroscience Research 2016, 94 (9), 804-813. DOI: https://doi.org/10.1002/jnr.23726

15. Bedner, P.; Dupper, A.; Huettmann, K.; Mueller, J.; Herde, M. K.; Dublin, P.; **Deshpande, T.**; Schramm, J.; Haeussler, U.; Haas, C. A.; Henneberger, C.; Theis, M.; Steinhaeuser, C. Astrocyte Uncoupling as a Cause of Human Temporal Lobe Epilepsy. Brain 2015, 138 (5), 1208-1222. DOI: https://doi.org/10.1093/brain/awv067

16. Kaundal, R. K.; **Deshpande, T. A.**; Gulati, A.; Sharma, S. S. Targeting Endothelin Receptors for Pharmacotherapy of Ischemic Stroke: Current Scenario and Future Perspectives. Drug Discovery Today 2012, 17 (13), 793-804. DOI: https://doi.org/10.1016/j.drudis.2012.02.017

Research Contributions and Scientific Profile

My research asks how glial, vascular, and extracellular-matrix interactions maintain brain homeostasis and how their disruption drives epilepsy, cerebral small vessel disease, and stroke-related pathology. Across academia and industry, I have combined mechanistic neuroscience, vascular biology, transcriptomics, and quantitative analysis to understand how cells of the neurovascular unit coordinate barrier integrity, excitability, and tissue resilience. A consistent theme of my work is that disease emerges not only from loss of individual components, but from altered communication between cellular compartments, and that these disruptions can be understood most effectively by integrating functional experiments with molecular profiling.

Translational Foundation and Vascular Pharmacology

At Dr. Reddy's Laboratories (2010-2012), I built my first research foundation in translational pharmacology. I developed statistical and predictive models to estimate the in vivo behavior of candidate formulations, performed pharmacokinetic analyses for preclinical and bioequivalence programs, and worked closely with formulation, analytical, clinical, and regulatory teams. This period trained me to think quantitatively about how biological mechanisms translate into therapeutic performance and how reproducible data support decision making in a regulated R&D setting.

In parallel, my shared first-author review on endothelin receptors in ischemic stroke (Kaundal et al., 2012) reflected an early and enduring interest in vascular mechanisms of neurological disease. In that work, we synthesized evidence that endothelin signaling contributes to post-ischemic hypoperfusion, blood-brain barrier dysfunction, and inflammation, and we evaluated the therapeutic potential of ETA receptor antagonism. This early work foreshadowed the neurovascular focus that would later become central to my research program.

Astrocyte Dysfunction in Epilepsy

During my PhD at the University of Bonn (2012-2017), I focused on astrocyte dysfunction in temporal lobe epilepsy. Astrocytes form gap-junction-coupled networks that buffer potassium, redistribute metabolites, and help stabilize neuronal activity, so disruption of this syncytium has immediate consequences for circuit excitability. Work from our group showed that astrocyte uncoupling is a defining and early event in human and experimental epilepsy (Bedner et al., 2015) and I contributed to showing that febrile seizures can reduce interastrocytic coupling before overt neuronal loss or reactive gliosis is established (Khan et al., 2016).

My major first-author contribution was to explain how this uncoupling occurs. In Deshpande et al. (2017), using human hippocampal tissue from epilepsy surgery together with mouse models, I demonstrated that seizure-associated astrocytic uncoupling is not simply caused by loss of gap junction proteins. Instead, connexin43 was increased overall but redistributed toward perivascular endfeet and showed altered C-terminal phosphorylation at sites relevant to channel permeability. This shifted the mechanistic framework from transcriptional loss to post-translational and trafficking-based dysregulation, and linked blood-brain barrier leakage and albumin extravasation to astrocyte network failure.

I extended this work in Deshpande et al. (2020), where I showed that constitutive deletion of astrocytic connexins aggravates chronic seizure and interictal spike activity after kainate-induced epilepsy. These data established that intact astrocyte coupling is functionally protective, even when some histopathological outcomes are dissociated from seizure burden. In parallel, our later work demonstrated that astrocytes in CA1 undergo early cell death during epileptogenesis, with evidence for necroptotic and autophagic mechanisms rather than classical apoptosis (Wu et al., 2021). Together, these studies positioned astrocytes not as passive responders to seizures, but as mechanistic drivers of epileptogenesis through altered connectivity, signaling, and survival.

Neurovascular Unit, Small Vessel Disease, and Vascular Zonation

After moving to the University of Munster (2017-2025), I broadened this astrocyte-centered perspective to the full neurovascular unit. The neurovascular unit depends on coordinated interactions between endothelial cells, mural cells, astrocytes, microglia, and basement membranes, and its compartmentalization shapes barrier function, fluid exchange, and immune surveillance. In Hannocks et al. (2018), I helped define the molecular architecture of perivascular drainage pathways in the murine brain, showing that pial, arachnoid, arterial, capillary, and venous compartments can be distinguished by specific laminin and structural marker signatures. This work provided an anatomical and molecular framework for studying waste clearance, vascular specialization, and immune access in the central nervous system.

My later first-author work applied this framework to cerebral small vessel disease. In Deshpande et al. (2024), I integrated histopathology, MRI-linked lesion analysis, and mouse-human comparison to show that white matter injury in nonamyloid small vessel disease is characterized by microglial activation, focal plasma protein leakage, and demyelination without

substantial peripheral immune-cell infiltration. This finding refined prevailing models of neuroinflammation by demonstrating that resident microglia and local vascular dysfunction can drive pathology independently of large-scale leukocyte entry, and it helped identify which mouse models most faithfully recapitulate human disease.

Alongside these disease-focused studies, I contributed to broader work on barrier and extracellular-matrix biology, including matrix-dependent astroglial barrier regulation at the blood-brain barrier (Burmeister et al., 2023) and extracellular-matrix organization in immune tissue microenvironments (Song et al., 2023). A major culmination of this phase is my recent first-author paper on vascular basement membrane laminins (Deshpande et al., 2026). Using single-cell RNA sequencing, imaging, and functional studies in genetic mouse models, I showed that laminin composition in the vascular basement membrane actively modulates functional zonation across cerebral microvessels. Loss of laminin alpha4 shifted endothelial identity, altered mural-cell programs, increased permeability-associated pathways, and worsened stroke outcome. This study advanced the field from descriptive vascular heterogeneity to a mechanistic view in which extracellular matrix composition instructs vascular specialization and disease vulnerability.

Across this body of work, transcriptomics has been a central tool rather than an endpoint. I have led or performed bulk and single-cell RNA-seq analyses, reanalyzed public datasets, and built pipelines that link molecular states to imaging and histopathology. This has allowed me to move from descriptive pathology to mechanistic models of how cellular identity is established within anatomical niches and how those states shape neurological disease.

Translational Bioinformatics and Therapeutic Development

In my current role as Senior Scientist and Project Leader for the Bioinformatics Platform at ProQR Therapeutics (2025-present), I have brought this mechanistic and quantitative approach into therapeutic development. I lead transcriptomic and bioinformatics efforts supporting RNA-editing programs for genetic disease, including analyses of target engagement, editing efficiency, isoform effects, and off-target risk. I design reproducible pipelines, automated reporting workflows, and data infrastructure that support decision making across preclinical programs, while also exploring AI-assisted approaches for predicting editing outcomes and prioritizing lead candidates.

Taken together, my research trajectory has progressed from translational pharmacology to glial mechanisms of epilepsy, and from there to neurovascular and extracellular-matrix biology in small vessel disease and stroke. The unifying question has remained constant: how does communication between cellular compartments preserve brain homeostasis, and how does its failure generate disease? I am now building a research program that combines mechanistic experimentation, transcriptomic discovery, and translational bioinformatics to understand and therapeutically target the neurovascular unit in neurological disease.