Rigshospitalet

Translational Research Centre







TRACE

ANNUAL REPORT 2024/2025

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Sygeplejebøger
Håndbøger
Patient
PROBLEM STILLINGER
GRAYS ANATOMY
FYSIOLOGI
BIOKEMI
PATHOLOGY
IBM SPSS
Systematic Reviews of Interventions
PATTERNS

Indhold

Introduktion - Dansk **6**
Introduction - English **7**
Strategy **8**
Our ambition 9
How are we organized? **11**
Who are we? **12**
Administration 12
The Medical Library 17
The Animal Facility 18
TRACE in Focus **20**
TRACE and Copenhagen University - New professorship **24**
Translational Research – Senior Scientist across the Atlantic: from Boston to BRIDGE **25**
Research Units at TRACE **26**
Bone and Biomarkers 27
BRAWA / Brain Water 31
Endocrine Disruption 34
Experimental Neurosurgery 36
Migraine Basic Research 38
Molecular Migraine & Pain Triggers 41
Multiple Sclerosis Research 43
Neuro Genomics 45
NVRU-B / Basic NeuroVascular and Neurorehabilitation Research 48
Reproductive Hormone Research 50
RNA therapeutics 53
Sensory Biology 56
VIPER / Visual Pathway Research 61
PhDs defended **64**

Academic Exchange **72**
Patent 76
Teaching 78
Prizes and recognitions 79
Honouring Departing Staf 80
New Grants **84**
Representation at conferences **85**
Scientific and social events in TRACE **86**
Glostrup Summer Symposium 86
Social club 88
TRACE International collaborations **90**
Publications **92**



Introduktion – DANSK

Det overordnede mål i TRACE er at understøtte translationel forskning på Rigshospitalet på højeste internationale niveau. I 2024 begyndte en transformation af TRACE og dermed en proces med at videreudvikle og opbygge vigtig infrastruktur til understøttelse af den translationelle forskning, således at TRACE i den nærmeste fremtid rummer alle nødvendige ekspertiser og kernefunktioner, som kan bygge bro mellem den basale forskning og den anvendte og implementerbare kliniske forskning. Vigtige initiativer i løbet af året var etableringen af en enhed for registerforskning med ansættelsen af en datamanager primo 2025, en funktion der er under fortsat opbygning og udvikling. Der blev ligeledes igangsat etablering af en laboratoriemanager funktion, som kan servicere laboratoriet og dets brugere bredt inklusive oversyn af alt udstyr i TRACE, oplæring af studerende m.m., en funktion som netop er blevet besat.

2024 har også været året, hvor vi har sagt farvel til højt værdsat personale, som har spillet en vigtig rolle for TRACE gennem de sidste mange år. Nye og værdsatte kollegaer er kommet til. Det har været en særlig glæde at byde velkommen til flere nye forskergrupper, som i løbet af året har etableret sig i TRACE.

Året har budt på nye spændende muligheder for samarbejde, som kan føre til vigtige fremskridt indenfor diagnostik og behandling. Særligt skal nævnes etableringen af Teknisk Universitets Hospital (TUH), som er et samarbejde mellem DTU og Region Hovedstaden, og som er et unikt partnerskab indenfor det teknisk-translationelle-kliniske forskningsområde. I TRACE har vi den store glæde, at vi har haft mulighed for at etablere os som en vigtig partner i dette samarbejde, hvilket allerede har ført til udvidelse af igangværende samarbejder med DTU forskere, samt fællesskab på akademisk niveau.

Endelig har der været en livlig og yderst vigtig social aktivitet og interaktion mellem forskerne i TRACE med social clubs og med Glostrup Summer Symposium, som er blevet en årligt tilbagevendende tradition, hvor både faglige diskussioner og netværk på tværs af forskningsgrupper styrkes.

Året har således budt på vigtige ændringer i TRACE til understøttelse af strategien om, at TRACE skal understøtte den translationelle forskning på Rigshospitalet på allerhøjeste internationale niveau. Dette sikrer, at TRACE også i fremtiden vil understøtte Rigshospitalets overordnede vision om at være til gavn for den enkelte patient og det samlede sundhedsvæsen.

Niklas Rye Jørgensen



Head of TRACE

Introduction – ENGLISH

The overall goal of TRACE is to support translational research at Rigshospitalet at the highest international level. In 2024, a transformation of TRACE was initiated, thereby starting a process aimed at further developing and building essential infrastructure to support translational research, so that TRACE in the near future will encompass all necessary expertise and core functions to bridge basic research and applied and implementable clinical research. Key initiatives during the year included the establishment of a unit for registry-based research with the hiring of a data manager at the beginning of 2025, a function that remains under ongoing development and expansion. In addition, the establishment of a laboratory manager function was initiated, intended to broadly service the laboratory and its users, including oversight of all equipment in TRACE, training of students, among other tasks; this position has now been filled.

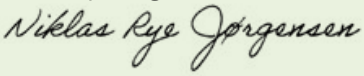
The year 2024 has also been marked by farewells to highly valued staff members who have played an important role for TRACE over the past years, as well as the welcoming of new, equally appreciated colleagues. It has been a particular pleasure to welcome several new research groups, who have established themselves at TRACE during the course of the year.

The year has offered new and exciting opportunities for collaboration, which may lead to important advances in diagnostics and treatment. Of particular note is the establishment of the Technical University Hospital (TUH), a collaboration between DTU and the Capital Region of Denmark, representing a unique partnership within the technical-translational-clinical research field. TRACE has had the significant opportunity to establish itself as an important partner in this collaboration, which has already led to the expansion of ongoing collaborations with DTU researchers, as well as the strengthening of academic community ties.

Finally, there has been lively and highly important social activity and interaction among researchers at TRACE, through social clubs and the Glostrup Summer Symposium, which has become an annual tradition, where both academic discussions and networking across research groups are strengthened.

The year has thus brought important changes within TRACE supporting the strategy that TRACE shall facilitate translational research at Rigshospitalet at the highest international level. This ensures that TRACE will continue to support Rigshospitalet's overarching vision of benefiting individual patients and the healthcare system as a whole.

Niklas Rye Jørgensen



Head of TRACE

Strategy

In 2024, TRACE began its transition toward becoming a structured and fully operational translational research centre. A central element of this process is the establishment of a core support structure that will strengthen internal coordination and enable efficient project execution across research teams. This development supports TRACE's function as a unified environment where experimental ideas can be tested and advanced in close interaction with clinical partners. The infrastructure is being aligned to facilitate complex, interdisciplinary research, including in vivo studies, ensuring TRACE can support the full spectrum from early discovery to translational application.

Moving forward, TRACE will consolidate its role as a convergence point for translational activities, where early-stage research is prepared for clinical application. The strategy prioritizes integration of advanced imaging, molecular methodologies, and registry-based, data-driven approaches to support mechanistic insight and feasibility. TRACE will further serve as an incubator for translational initiatives, including collaboration with early-stage biotech partners and preparation of competitive, interdisciplinary grant proposals. Through its physical and strategic position within the Technical University Hospital of Greater Copenhagen (TUH), TRACE will operate as a key gateway between Technical University of Denmark (DTU), University of Copenhagen and Rigshospitalet, facilitating technical innovation and clinical implementation.

Our ambition

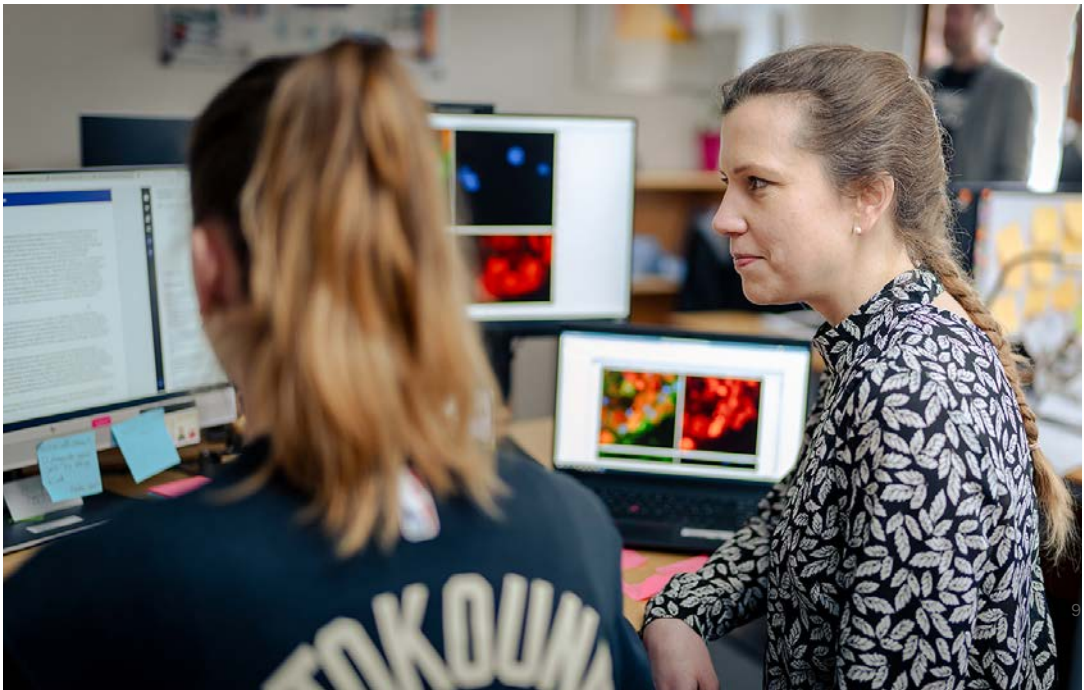
At TRACE, we do world-leading translational research that transforms basic science into clinical solutions for improved patient care and enhanced public health. We do this through international collaborations with both public and private sector partners, by housing state-of-the-art research facilities, by nurturing an attractive research environment, and by engaging with health care professionals and policy makers.

We currently focus on areas such as stroke, headaches, migraine, sensory biology, ophthalmology, bone diseases, and multiple sclerosis but welcome any group dedicated to translational research that shares our values.

We value the strength of teamwork and have a collaborative and trustful working environment extending to all employees and students.

We empower young researchers and have a vibrant research training community that thrives on trustful supervision and mentorship, curiosity, creativity, and intellectual rigor.

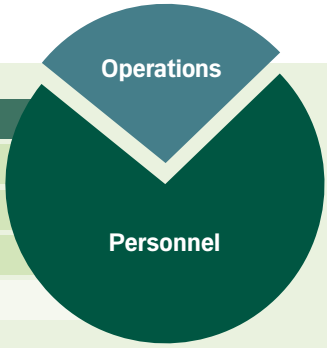
We engage with the local and global community via public outreach, social media and news outlets, and involve all employees and students.



Economy Overview - 2024

Financial Summary - actual Expenses (t. DKK)

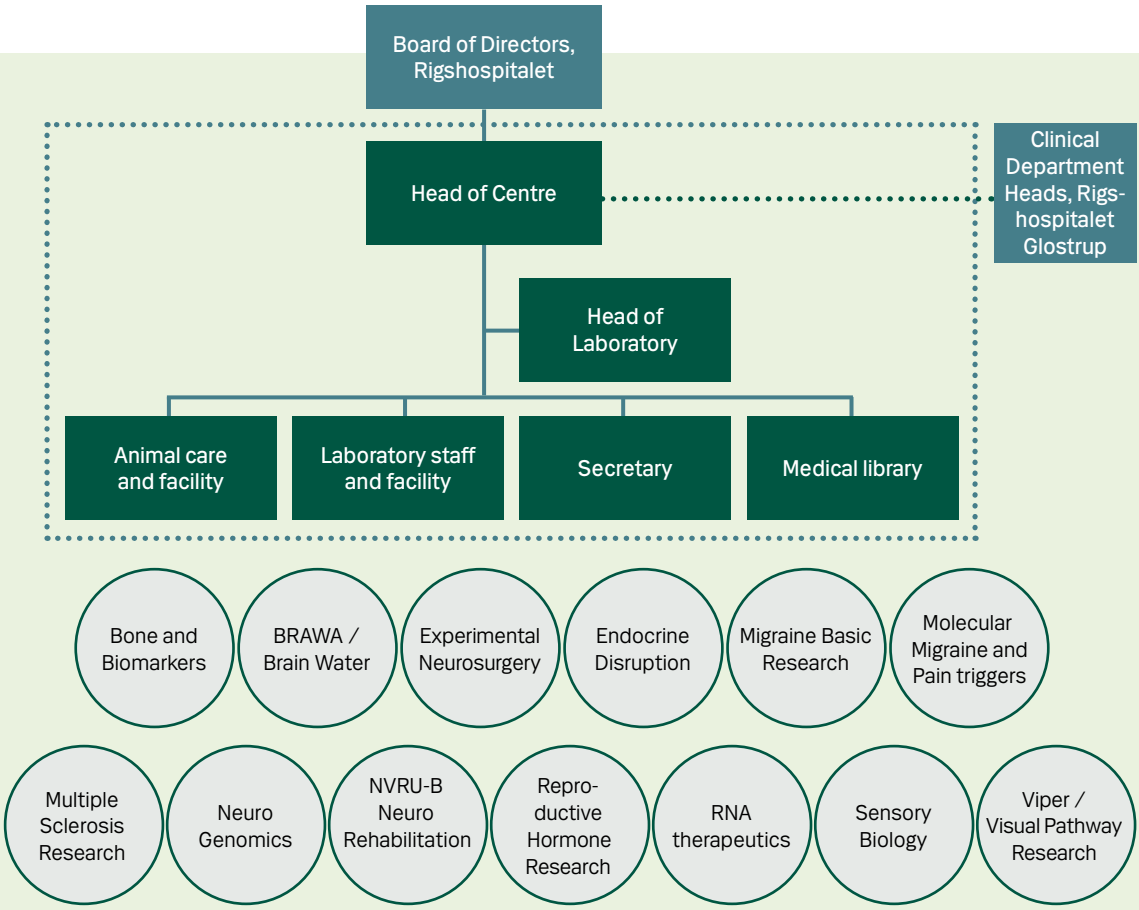
Category	Actual (t. DKK)
Centre Budget	6,343
Personnel	4,589
Operations	1,712
Net Result	**42**



The financial status for 2024 is healthy, with actual expenses well managed within the yearly budget, resulting in a small net surplus of 42 t. DKK.



How are we organized?



The diagram illustrates the organizational structure of TRACE within the dotted line. These components form the core operational framework of the centre.

Outside the dotted line are various research units that organizationally belong to other departments. These research units interact with the centre as part of their collaborative efforts. The central leadership communicates with the clinical department heads and other stakeholders to coordinate these interactions and ensure alignment with the centre objectives in support of Rigshospitalet's vision and strategy.

Who are we?

This section provides an overview of our current staff and their contributions.

ADMINISTRATION

Niklas Rye Jørgensen, Head of Centre. Niklas is focused on reinforcing the integration of clinical and basic research with focus on strategic development. In addition to being head of TRACE, he is head of Section of Clinical Biochemistry, Rigshospitalet Glostrup and professor of clinical biochemistry at the Department of Clinical Medicine, Faculty of Health and Medical Sciences, University of Copen hagen.



Niklas Rye Jørgensen

Kristian Agmund Haanes, Head of Laboratory and Deputy Head of Centre, is the daily manager of TRACE with particular focus on effective execution and implementation of new initiatives. In addition to his administrative tasks at TRACE, Kristian is heading his own research group at the site (Sensory Biology) and is associate professor at the Department of Biology at Faculty of Science, University of Copenhagen.



Kristian Agmund Haanes

Anja Holm, Lab Specialist, is responsible for supporting laboratory operations with a focus on equipment management, technical support, and sustainability initiatives. In addition to her specialist role, she leads the RNA Therapeutics group at the site and holds an Associate Professorship at the Technical University of Denmark (DTU), where she contributes to research and education in molecular therapeutics.



Anja Holm

Thomas Folkmann Hansen, Data Specialist, is responsible for supporting register-based and epidemiological research at TRACE and Rigshospitalet, with a focus on project design, data extraction, statistical analyses, and the use of Danish health registries. In addition to his specialist role, he leads the NeuroGenomics Group, which focuses on genetics and genomics in neurology. He is also Associate Professor at University of Copenhagen.



Thomas Folkmann Hansen

Mona Sadek Ali, Lab manager, is responsible for the daily operations of the laboratory at TRACE with focus on maintenance of equipment, technical support, and quality assurance. Provides assistance and training to students, researchers, and medical doctors, supports in vivo studies, and ensures compliance with safety and research standards. Supports all users of the shared infrastructure at the centre and contributes to strengthening the research environment at the centre and the hospital.



Mona Sadek Ali

Nana Aviaaja Lippert Rosenø, Data manager, is responsible for supporting register-based and epidemiological research at TRACE and Rigshospitalet. Provides assistance with project design, data extraction, statistical analyses, and guidance on the use of Danish health registries. Supports researchers across the centre and the hospital in applications for data access and project registration and contributes to the establishment of research databases based on clinical cohorts.



Nana Aviaaja Lippert Rosenø

Lene Winther, Secretary, is employed part-time at the centre, assisting with general administrative operations. Tasks include coordinating internal meetings, managing Optima entries, handling vacation registration, overseeing supply orders, and maintaining an overview of equipment and facilities to support the smooth functioning of the centre.



Lene Winther

THE MEDICAL LIBRARY

The Medical Library at Rigshospitalet Glostrup supports all staff at Rigshospitalet with comprehensive services, including managing Pure registrations, sourcing hard-to-find references, and maintaining a collection of relevant literature.

Karine Korsgaard, Librarian, is the superuser for the hospital's Pure registration system. She also assists with literature searches, sourcing hard-to-find references, and provides guidance to scientists.



Karine Korsgaard

Lene Madsen, Office Clerk/Librarian, manages library tasks and supports Pure registration duties. In addition, Lene oversees the budget and finances of TRACE, including invoicing and payments, ensuring efficient financial operations.



Lene Madsen

THE ANIMAL FACILITY

The Animal Facility at TRACE maintains high standards of animal welfare and supports scientific research, ensuring their living conditions meet regulatory standards. All animal caretakers maintain the animal facility and ensures the well-being of the animals by providing daily care.

Sara Stefansen, Animal Technician, who started in 2023, is the full-time animal technician. Sara's dedication to animal welfare is evident in her attention to the needs of the animals and her role in training new staff on best practices. She is conducting routine health checks and providing enrichment to enhance the quality of life for the animals. Sara also performs administrative duties related to TRACE and assists scientists with their experiments when time allows.



Sara Stefansen

The veterinary students at the University of Copenhagen are dedicated to animal care during weekends and holidays, contributing to the well-being of the animals and supporting the facility's operations. They are:



Malene Tærsbøl Jepsen



Jannie Jeppesen



Ida Østrup



Kenneth Christensen



The Medical Library

The Medical Library at Rigshospitalet Glostrup is located at the Translational Research Centre. The Medical Library has organizationally moved from TRACE to Stab: Sekretariat og Jura 1. february 2025. Our primary goal is to assist employees at Rigshospitalet Glostrup in finding the health knowledge they need.

One of our main purposes is to support employees in seeking information on health-related topics. With our expert competences, we help our users develop thorough searches for relevant knowledge. The quality of these searches is crucial, and we assist in navigating smoothly through the process of creating a database and exploring search techniques.

We also offer to help researchers in finding relevant journals to publish in with Open Access without paying article processing charges or at a discounted rate. In this process, we use the "Journal Finder" from the Royal Danish Library. The "Journal Finder" provides an updated list of journals with publication agreements: https://kb.chronoshub.io/

Another significant part of our work is registering research articles affiliated with Rigshospitalet. Rigshospitalet publishes approximately 3,500 research articles each year. The purpose of this registration is to highlight and provide an overview of the research carried out at Rigshospitalet. The tool used for registration is a web-based IT system (Pure).

The Pure web portal can be accessed at the web address: https://research.regionh.dk/en/

The data from Pure can be used for branding research groups, departments, and Rigshospitalet as leading entities. The data shows all research performed, both nationally and internationally. Potential collaborators can also find relevant researchers for future cooperation opportunities.

The Medical Library at Rigshospitalet Glostrup also has a book collection consisting of approximately 1,500 books, including nursing literature and medical handbooks.

The Animal Facility

Animal welfare is important to us, and we strive to provide the highest standard for the animals in our facility. We aim to ensure that the animals are housed in a way that will contribute to their physiological and behavioural needs, and that they are provided with an environment that is as calm as possible for the animals to breed and participate in our studies.

The animal facility houses mice and rats in open conventional type III and type IV cages, and we prioritize the welfare of animals by focusing on species-specific needs. We offer our rodents different enrichment in the cages to stimulate their natural behaviour, and all of our animals are given peanuts, corn, sunflower seeds, and hay bricks as a supplement to their normal diet. This is to stimulate foraging and gnawing behaviour.

We have a variety of enrichments for our animals, such as four different nesting materials for our mice, different types of shelters, a chew stick, a hammock, a cardboard tunnel in the lid, hemp rope, a handle tube, and bedding.

Our rats have a shelter, different types of tunnels, a chew stick, two different nesting materials, hemp rope, and bedding. Every week we also offer our rats scented enrichment such as chew sticks, hemp rope, cocoons, happi mats, etc., to stimulate their senses.

Water and a normal diet are freely available, and our animals are only handled by cupping or with tunnels to minimize stress.



TRACE in Focus

TRACE and the new Technical University Hospital of Greater Copenhagen (TUH)

The Technological University Hospital Copenhagen (TUH) is a unique initiative that merges the clinical expertise of the hospitals of the Capital Region and the engineering expertise of the Technical University of Denmark (DTU) to foster innovation in healthcare. DTU's expertise in engineering and technology complements the hospitals' focus on healthcare, making this partnership a driving force in the development of medical technologies and solutions. By combining clinical experience with technological innovation, the collaboration will lead to more effective treatments, personalized medicine, and improvements in patient outcomes as well as paving the way for a sustainable healthcare system with equity in health.

Rigshospitalet, known for its world-class medical services, stands as a hub for patient care and clinical research. TRACE at Rigshospitalet is integral to bridging the gap between laboratory research and clinical application, translating discoveries into tangible treatments. TRACE's focus on translational research ensures that breakthroughs are not only theoretical but applicable to real-world healthcare challenges. Moreover, through TRACE the TUH partnership may accelerate the development of medical devices, diagnostic tools, and therapeutic techniques. The first steps have already been taken to initiate this valuable collaboration through TRACE with appointment of associate professor Anja Holm, and more collaborative research projects and inter-institutional academic appointments are on their way. These will contribute to shaping the future of healthcare by developing pioneering solutions, setting new standards, and advancing scientific discovery in the unique model for innovation created by the TUH collaboration. TRACE and DTU builds on excellent research as the foundation for innovation and impact. By establishing inter-institutional academic positions, we are further strengthening the academic environment and interdisciplinarity, and make the excellent infrastructures at both sites available to our staff.

TUH is supported by the Academy for Technology in Health, which serves as the academic and administrative backbone for its initiatives. In 2024, the Academy was led by:

- Professor Jan Henrik Ardenkjær-Larsen, Director of DTU Health Tech, who focuses on advancing health technology through innovative engineering approaches.
- Professor Malene Fischer, Director of Research at Rigshospitalet, who brings expertise in clinical research and strategic leadership to foster impactful collaborations.
- As of January 1st 2025, Professor Christian Hassager, Department of Cardiology at Rigshospitalet succeeded Malene Fischer as Academic Lead in Region H in the TUH collaboration.



Malene Fischer
Director for Research, Innovation and Education, Rigshospitalet



Jan Henrik Ardenkjær-Larsen
Head of Department, DTU Health Tech

Vision and Goals

TUH focuses on meeting the demands of a healthcare system facing an aging population and increasing needs for specialized care. It creates a collaborative framework where engineers and healthcare professionals work side by side to develop groundbreaking solutions. TUH also seeks to eliminate systemic barriers, scale interdisciplinary projects, and educate more engineers specializing in health technologies. Through these efforts, TUH aspires to advance healthcare for the benefit of patients, healthcare providers, and society. TRACE is envisioned as a bridge between technological development and clinical application within the framework of TUH.

Spotlight on a TRACE / TUH Researcher:
Anja Holm

Dr. Anja Holm serves as an Associate Professor at DTU Health Tech and Senior Researcher at the TRACE, Rigshospitalet. Her expertise lies in RNA therapeutics, specializing in drug design and delivery to address unmet medical needs in areas such as immune-related disorders, neurological diseases, and cancer.

Reflecting on her role at TUH, Anja notes:

"TUH provides a unique platform for interdisciplinary collaboration, granting access to state-of-the-art equipment and expertise. This environment enhances my ability to develop RNA-targeted therapies, particularly by improving their design and delivery—a critical combination for bringing these treatments closer to benefiting patients."

TUH



Anja Holm
Associate professor, TUH



TRACE and Copenhagen University – New professorship

Lasse Bak was appointed as professor of applied and clinical biochemistry at the University of Copenhagen, Department of Drug Design and Pharmacology, in December 2023. The professorship is a five-year appointment, and he held his inaugural lecture in May 2024 entitled “It’s biochemistry, stupid”.

Lasse’s strategy for his academic activities in the coming five years is structured around three core pillars: (i) through research, to improve the diagnostic and the therapeutic drug monitoring (TDM) services offered at the Department of Clinical Biochemistry; (ii) to integrate his research with teaching and mentoring activities; and (iii), to foster collaborative research initiatives between TRACE and Department of Drug Design and Pharmacology.

Three themes define Lasse’s current research activity. The first is osteocyte biology and biomarkers, where Lasse studies how osteocyte-derived molecules, such as sclerostin, function as biomarkers for bone-related diseases, including multiple myeloma-induced bone destruction. The second theme focuses on pharmacokinetic modelling, using real-world TDM data to improve drug dosing strategies. This work is done in collaboration with colleagues at Department of Drug Design and Pharmacology, who are experts in pharmacokinetic modelling. The last theme is termed clinical laboratory performance, where Lasse works to strengthen the clinical laboratory’s analytical capabilities by expanding the immunoassay and LC-MS/MS infrastructure to support both routine diagnostics as well as research, the latter for both in-house projects and Department of Clinical Biochemistry’s clinical research support activities.

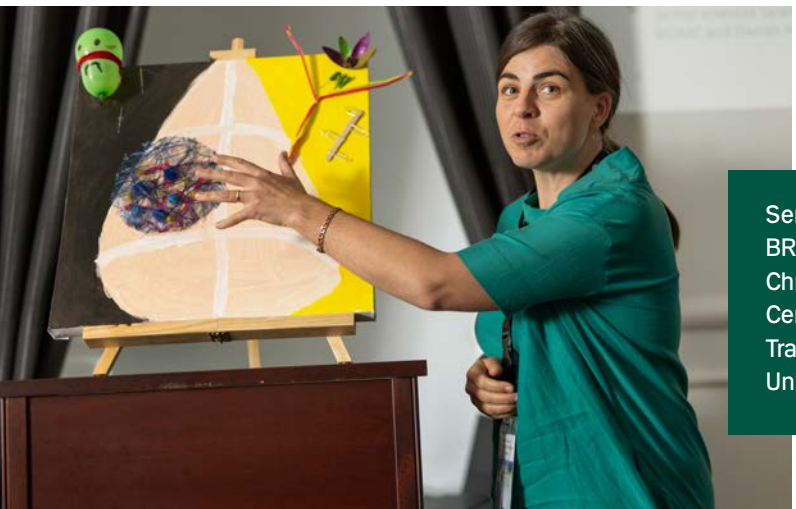


Translational Research – Senior Scientist across the Atlantic: from Boston to BRIDGE

Translational research has historically proven difficult and characterized by a major gap from basic science to clinical implementation of discoveries. Clinical trial attrition rates due to lack of drug efficacy in patients remain high. These figures call for improvements in preclinical development and target discovery. As group leader of a preclinical lab focusing on drug target discovery for migraine, I strive to leverage our research to achieve scientific advancements that will ultimately translate into clinically useful treatments. To pursue this aim, I transitioned with my family to Boston in 2023 to work in Dr. Dan Levy's lab at Beth Israel Deaconess Medical Center – Harvard Medical School. Here, I learned and applied a cutting-edge two-photon in vivo imaging technique and established new collaborative projects with Dr. Levy. While in Boston, I was privileged to keep my position as group leader at TRACE reflecting the fact that it was not just a new job in the US – but an effort made to elevate our research in Denmark and establish a solid collaboration. The scientific environment in Boston is one of a kind and very inspirational with a strong tradition of translational collaboration between academia and industry.

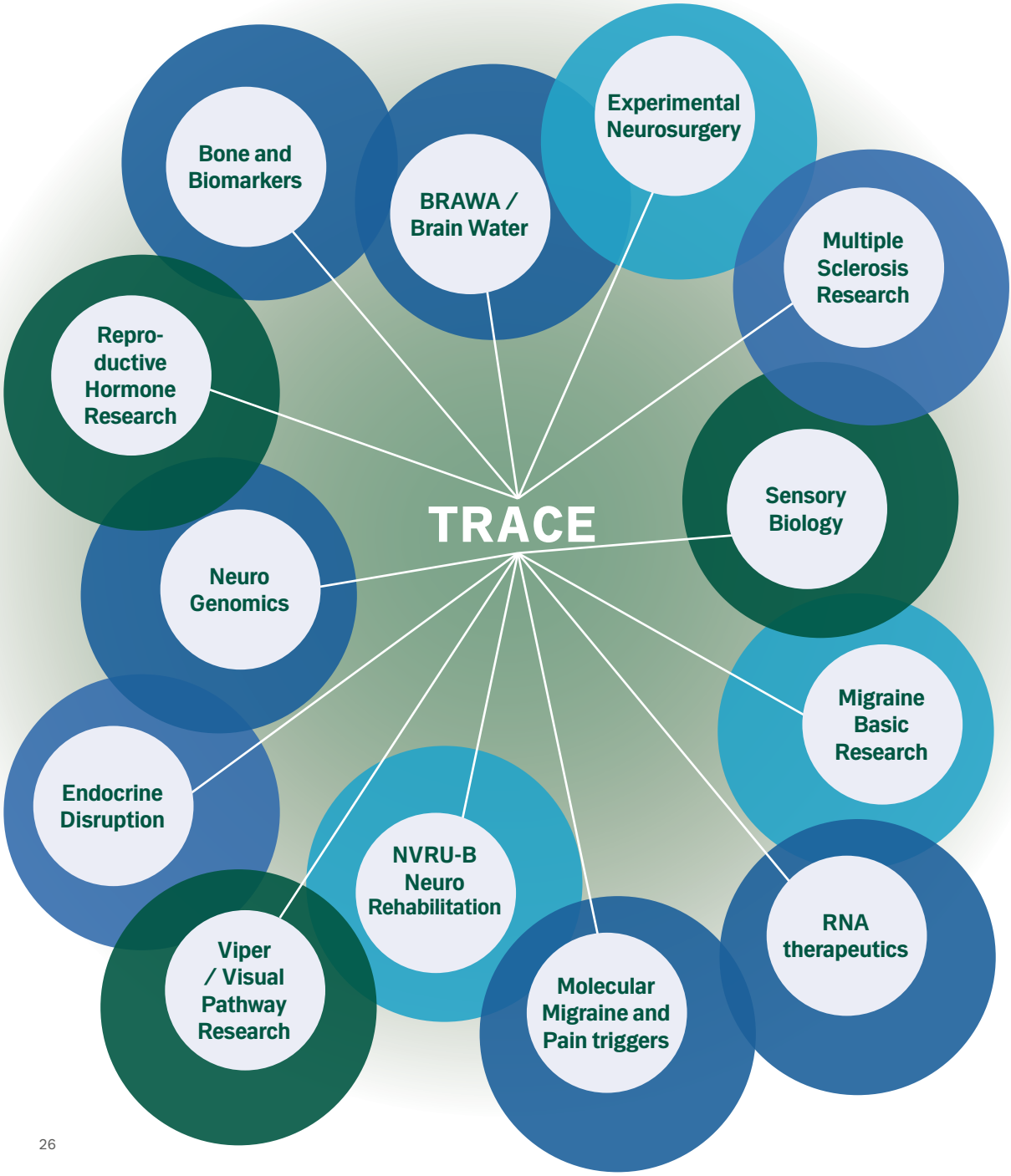
After 20 months in the US, I have initiated another cooperative fellowship as part of the BRIDGE – translational excellence programme at University of Copenhagen. Here, collaboration is between Center for Translational Neuromedicine – UCPH, Danish Headache Center – Rigshospitalet, and Lundbeck A/S. Thus, the project involves partners and expertise across the circle of translational research: Basic (neuro)science, clinical know-how, and pharmaceutical industry. The value is not only the specific scientific project itself – but also the scientific relations derived from it.

This case is an example of agility in research where physical location is not the determinant of affiliation. It illustrates how collaboration between groups with different areas of expertise may lead to novel scientific approaches and hopefully improved translational results.

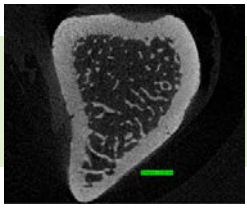


Senior Scientist and BRIDGE-fellow Sarah Louise Christensen, Danish Headache Center, TRACE, and Center for Translational Neuromedicine, University of Copenhagen

Research Units at TRACE



BONE AND BIOMARKERS



Principal Investigator – Niklas Rye Jørgensen



Professor
Department of Clinical Medicine,
Faculty of Health and Medical Sciences,
University of Copenhagen

Chief physician
Department of Clinical Biochemistry

Principal Investigator – Lasse Kristoffer Bak



Professor
Department of Drug Design and
Pharmacology, Faculty of Health and Medical
Sciences University of Copenhagen

Pharmacist
Department of Clinical Biochemistry

The research is focused on two major areas. The first investigates the pathophysiological mechanisms of metabolic bone diseases with special emphasis on bone disease in relation to other chronic diseases including neurological diseases, immobilization, cancer, diabetes and medicine-induced bone loss. There is a strong focus on the development and evaluation of novel biomarkers for bone disease. The approach includes both basic laboratory studies, animal models as well as clinical studies and epidemiological/register-based studies enriched with clinical data. Thus, a true translational approach is applied. Current projects focus on the mechanisms for developing bone destruction in multiple myeloma, iatrogenic bone loss associated with treatment of other chronic diseases, and finally the clinical use of bone turnover markers for monitoring anti-osteoporotic treatment and for monitoring treatment pause in osteoporosis patients.

The second area of research is on therapeutic drug monitoring (TDM) and pharmacokinetic models where we focus on developing new models for prediction of clinical outcome based on clinical data and measurements of blood concentrations of different drugs for a more personalized approach to dosing of patients. TDM includes both new models for predicting efficacy of already established drug analyses but also exploration of new analyses of medicines where TDM has not previously been used.

Ankita Agrawal – Senior scientist



Exploring the relevance of extracellular adenine nucleotides and ionotropic purinergic receptor 7 (P2X7) in multiple myeloma a haematologic disease that attacks the bone tissue.

Michael Schønemann Rand – 2nd year PhD



The research investigates the effectiveness of bone turnover marker monitoring of oral bisphosphonate therapy in patients with osteoporosis in regard to increasing medication adherence, improving bone mineral density, and reducing the risk of fractures.

Morten Christian Melchior Nissen – Research Assistant



The research investigates the clinical usefulness of monitoring of osteoporosis patients during treatment pause.

Susan Herrmann – Chemist, Department of Clinical Biochemistry



Research within purinergic signalling in health and disease, the role of neuropeptides in the regulation of bone metabolism as well as exploring the clinical applications of urinary steroid metabolite profiling.

Jennifer Anton Stud. Scient. Pharm, master project



The research consists of Urinary Steroid Profiling by GC-MS as a Diagnostic Tool for Malignancy in Adrenocortical Tumours.

Nadia Mazarwal og Dalia Hasan Al Subaih, Stud. Pharm, master project



The research compares two kits for quantifying plasma PTHrP in the diagnosis of PTHrP-producing tumours.

Tanja Hegner – Animal Technician



Assists researchers by preparing equipment and materials, handling animals, recording data, and ensuring all procedures adhere to established protocols during experiments.

Co-supervised students: PhD students: Sabina Hauge (Niklas), Gowthami Gunapalasingham (Niklas) Sofie Norlin Mølgaard (Niklas).

Publication Highlights in 2024

Guidelines for the correct use of the nomenclature of biochemical indices of bone status: a position statement of the Joint IOF Working Group and IFCC Committee on Bone Metabolism. Lombardi G, Jørgensen NR, Harvey NC, McCloskey EV, Åkesson KE, Eastell R, et al. Clin Chem Lab Med. 2025;63(4):704-11.10.1515/cclm-2024-1148

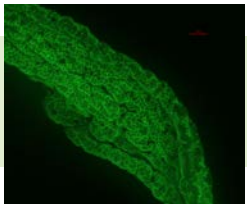
Academic engagement

Grant committee: Evaluation committee in Region H for research funding. Review Panel, Natural Science in the EU programme on Cooperation in Science and Technology.

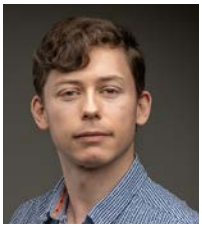
Scientific committees: Scientific advisory board: P2X receptors as therapeutic targets (PRESTO), EU funded Action on Cooperation in Science and Technology, Management Committee and Science Communication Coordinator of PRESTO. International Society of Bone Morphometry (ISBM) Early Career Investigators Committee. Danish Society for Clinical Biochemistry: Committee for the specialist training program in clinical biochemistry. National working group on therapeutic drug monitoring. Committee on advancement of research, Danish Society for Clinical Academics. International Osteoporosis Foundation: Scientific Advisory Committee. International Federation for Clinical Chemistry: Committee for Bone Metabolism. ESCEO Working Group on Bone Turnover Markers in the diagnosis and management of osteoporosis.

Editorial work: Editorial board for Neurochemical Research, Frontiers in Endocrinology, Current Opinion in Pharmacology (associate editor), Purinergic Signalling

BRAWA / BRAIN WATER



Principal scientist – Connar Stanley James Westgate



Senior Scientist
Danish Headache Center,
Department of Neurology
Rigshospitalet-Glostrup.

Our team's research investigates the biology and pathophysiology of cerebral hydrodynamics and intracranial pressure using the disease idiopathic intracranial hypertension (IIH) as a disease model. Intracranial pressure physiology is poorly understood, so focusing on a model disease enables us to investigate unknown biology while being driven by clinical need. We particularly focus on understanding the role of endocrine and metabolic dysfunction of intracranial pressure, while investigating the clinical sequalae of raised pressure, namely headache and ocular outcome. Here we wish to elucidate the mechanisms underlying raised intracranial pressure and the process that underly neuroretinal degeneration in raised intracranial pressure.

We also perform biochemical phenotyping of IIH patients with an aim of changing clinical practice through prognostic and diagnostic markers, as well understanding the underlying pathophysiology of IIH. These findings directly inform our animal research ensuring truly translational research. Our ultimate aim to understand the biology of intracranial pressure to enable us to develop targeted therapies that can alleviate raised pressure and its detrimental clinical sequalae for the benefit of patients.

Rigmor Højland Jensen – Professor, Overlæge, Dr.med., Director for Danish Headache Center



Leader of the translational CSF-research group and focus mainly on the clinical human aspects of IIH, secondary causes of increased intracranial hypertension and of spontaneous intracranial hypotension.

Christina Kamp-Jensen, cand Pharm, 2nd year PhD



Funding by Lundbeck Foundation and Rigshospitalets Research Foundation. The research investigates the distribution of sex hormones and their role in CSF-production. Moreover, Christina is investigating the steroid hormone profile in IIH patients with a view towards diagnostic and prognostic factors.

Tanja Lylloff, cand Pharm, 1st year PhD, funded by Novo Nordisk Foundation.



The research focuses around understanding the role of steroid hormones in multiple headache disorders including cluster headache and IIH with a view to improving diagnosis and therapeutic intervention. Moreover, Tanja will investigate the role of recently identified biomarkers in IIH pathophysiology.

Juliana Ramos de Andrade, PhD. Post-Doc, funded by Brazilian Research Council



Juliana research host focused on delineating the effects of raised ICP in humans including ultrastructural changes, as well as proteomic changes.

Nadja Skadkær Hansen, MD, 3rd year PhD student, Funding by Novo Nordisk Foundation.



The clinical research investigates treatment effects of GLP1-agonism on weight loss and intracranial pressure in patients with new-onset idiopathic intracranial hypertension, along with metabolic parameters, visual outcomes, headache burden and quality of life. Moreover, Nadja investigates the clinical and biochemical presentation at time of diagnosis in order to identify biomarkers and improve diagnostic accuracy.

Publication Highlights in 2024

Metabolic Dysfunction in New-Onset Idiopathic Intracranial Hypertension: Identification of Novel Biomarkers. Korsbæk JJ, Jensen RH, Beier D, Wibroe EA, Hagen SM, Molander LD, et al. Ann Neurol. 2024;96(3):595-607.10.1002/ana.27010

Acetazolamide and topiramate lower intracranial pressure through differential mechanisms: The effect of acute and chronic administration. Westgate CSJ, Kamp-Jensen C, Israelsen IME, Toft-Bertelsen T, Wardman JH, Jensen CA, et al. Br J Pharmacol. 2024;181(1):70-86.10.1111/bph.16213

Other Group members

Henrik Schytz, ass. Professor, PhD and Dr.Med Sci and Casper Emil Christensen, PhD, neurologist, Danish Headache Center, Dagmar Beier, MD, Professor, Odense University Hospital, Vlasta Vukovic Svetkovic. MD, Senior Registrar, Danish Headache Center, Ronya Sari, Stud med, Danish Headache Center, Areeba Rehman, Pharm Stud. Gabriel Bsteh, Ass. Professor, Department of Neurology, University of Vienna, Austria

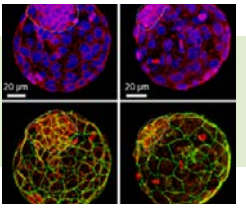
Academic engagement 2024

Scientific advisory board: Rigmor Hoejland Jensen is serving in the Advisory Board for Lundbeck Pharma
Other committees: Rigmor Hoejland Jensen is serving as Study lead for Master of Headache Disorders, University of Copenhagen and Director in Lifting The Global Burden (WHO-organisation)

Funding

Thanks to the Lundbeck foundation, Rigshospitalets Research foundation, Migræne fonden af 1988 and Novo Nordisk Foundation

ENDOCRINE DISRUPTION



Principal Investigator – David M Kristensen



Senior researcher
Copenhagen University Hospital

Professor
Molecular Physiology,
Department of Science and
Environment

Our team's research focus on understanding how the environment impacts human development and adult homeostasis. We are doing this by using clinical studies in combination with animal models, cellular assays, and modelling. The central aims of this work have been in a translational manner to understand disease mechanisms and create better treatments for patients by: (i) identifying new drug targets; (ii) understanding off target effects of drugs already in the clinic; and (iii) understanding how ubiquitous xenobiotics can drive recent increases in prevalence of adverse health outcomes within reproduction, metabolism, and neurobiology.

Brian Skriver Nielsen, Post Doc



Funding by the Miljøstyrelsen. Brian is leading several projects involving effects on metabolism and brain development in relation to xenobiotic exposures.

Heidi Katharina Mjøseng, Post Doc



Funding by the DFF.
Heidi is leading projects involving early embryonic loss and sexual differentiation.

Brennan Baker, Post Doc



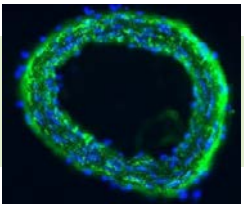
Funding by the Lundbeck Fonden, NIH and Seattle Children's Hospital.

Brennan is based in the US and is leading projects involving fetal exposures and neurodevelopmet disorders.

Publication Highlights in 2024

Overuse of analgesics can affect the fertility biomarker Anti-Müllerian Hormone in females. A translational study. Carlsen LN, Nielsen BS, Rouw C, Petersen MR, Lindh CH, Krais AM, et al. Cephalalgia. 2024;44(11):3331024241290530.10.1177/03331024241290530

EXPERIMENTAL NEUROSURGERY



Principal Investigator – Tiit Mathiesen MD, Dr. Med



Professor
Faculty of Health and Medical Sciences, University of Copenhagen and Neurosurgical Department, Rigshospitalet - Blegedamsvej

Our research group is dedicated to developing innovative treatments for subarachnoid haemorrhages, where acute biochemical cascades such as vasoconstriction, metabolic imbalance, and progressive brain damage critically impact patient outcomes. We aim to elucidate the underlying pathobiology of endothelin B receptor upregulation and assess the efficacy of MEK 1/2 inhibitors in mitigating these detrimental reactions. To achieve this, we conduct clinical studies and patient trials on individuals experiencing subarachnoid haemorrhages, while simultaneously engaging in translational research using rodent models to investigate the effects of biochemical interventions on cerebral vasculature and neural tissue. Additionally, we perform basic studies to explore the interaction between MEK 1/2 inhibitors and endothelial cells, striving to optimize delivery methods that ensure timely administration within the critical eight-hour window post-haemorrhage. By bridging laboratory discoveries with clinical applications, our goal is to improve survival rates and reduce long-term disabilities, ultimately enhancing the quality of life for patients affected by cerebral haemorrhages.

Lars Edvinsson MD, Professor in Internal Medicine, Faculty of Medicine, University of Lund



The research is focused on developing a novel treatment for subarachnoid haemorrhages by targeting endothelin B receptors to interrupt harmful biochemical cascades. Additionally, he is involved in the clinical trial of MEK 1/2 inhibitors through his company Edvince, aiming to improve patient outcomes.

M Emelie Pitkänen Fungbrant, MD, 2nd year PhD



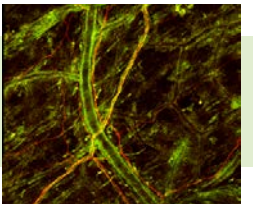
Funding by Rigshospitalet.
The research investigates the role of MEK1/2 and PKC in treatment of experimental subarachnoid haemorrhage using behaviour methods and in vivo MRI T7 in collaboration with the MR centre at Hvidovre Hospital.

Publication Highlights in 2024

Predictors of shunt insertion in patients with aneurysmal subarachnoid haemorrhage-a single-centre retrospective analysis. Capion T, Lilja-Cyron A, Olsen MH, Møller K, Juhler M, Mathiesen T. Acta Neurochir (Wien). 2024;166(1):24.10.1007/s00701-024-05926-1

Other Group members and Co-supervised students:
Part time Senior Researcher Anja Holm (RNA therapeutics) and Spyridoula Kazantzi PhD Student (Sensory Biology), characterization of signalling pathways that are activated in arteries following in a model mimicking stroke, utilizing myograph techniques.

MIGRAINE BASIC RESEARCH



Principal Investigator – Sarah Louise T. Christensen



Senior scientist
Department of Neurology, Danish Headache Center, Rigshospitalet
– Copenhagen University hospital

BRIDGE fellow
Center for Translational Neuromedicine, University of Copenhagen

The focus of our research is to understand migraine pain mechanisms and identify potential therapeutic targets. This is done via development and validation of animal models of migraine based on findings in human migraine provocation studies. The animal models are applied in behavioural assays and in vivo imaging to decipher molecular signalling pathways involved in migraine pain and identify contributions from different cell types of the trigeminovascular system. We apply various transgenic mouse strains, chemical tools, ex vivo techniques, and biochemical assays.

Karina Obelitz Ryom, Postdoc



Funded by Region Hovedstadens Forskningsfond.
Research focussing on migraine pain mechanism using in vivo mouse models. Primary focus is on potassium channels and their role in migraine induction and Piezo channels as sensors and transmission of trigeminal pain.

Rikke Holm Rasmussen, Postdoc



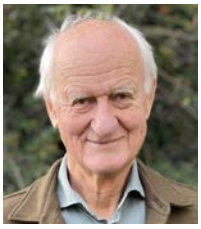
Funded by Foreningen til støtte af forskning ved Dansk Hovedpine Center.
Research aiming to understand migraine signalling mechanisms between blood vessels and trigeminal neurons at a molecular level. Primarily working with ex vivo and in vitro techniques.

Song Guo MD, Translational Senior Scientist



Funded by Foreningen til støtte af forskning ved Dansk Hovedpine Center.
Neurologist and headache specialist at the Danish Headache Center, Department of Neurology and active part of our research group. Primary research interest is the mechanisms of PACAP38 induced headaches and translational research in general.

Jes Olesen, MD Professor Emeritus



Previous PI of the lab. Now part time active as researcher and mentor for all group members. Founder of start-up company Cephagenix. Contract research performed at Trace has greatly supported external investments from French and American venture capital companies in Cephagenix.

Caroline Degel, Research Assistant



Funded by Independent Research Fund, Denmark. Primary research interest is in vivo imaging in combination with behavioural analysis to understand meningeal mechanisms of migraine pain. Works with miniscope technology for imaging in collaboration with Lundbeck.

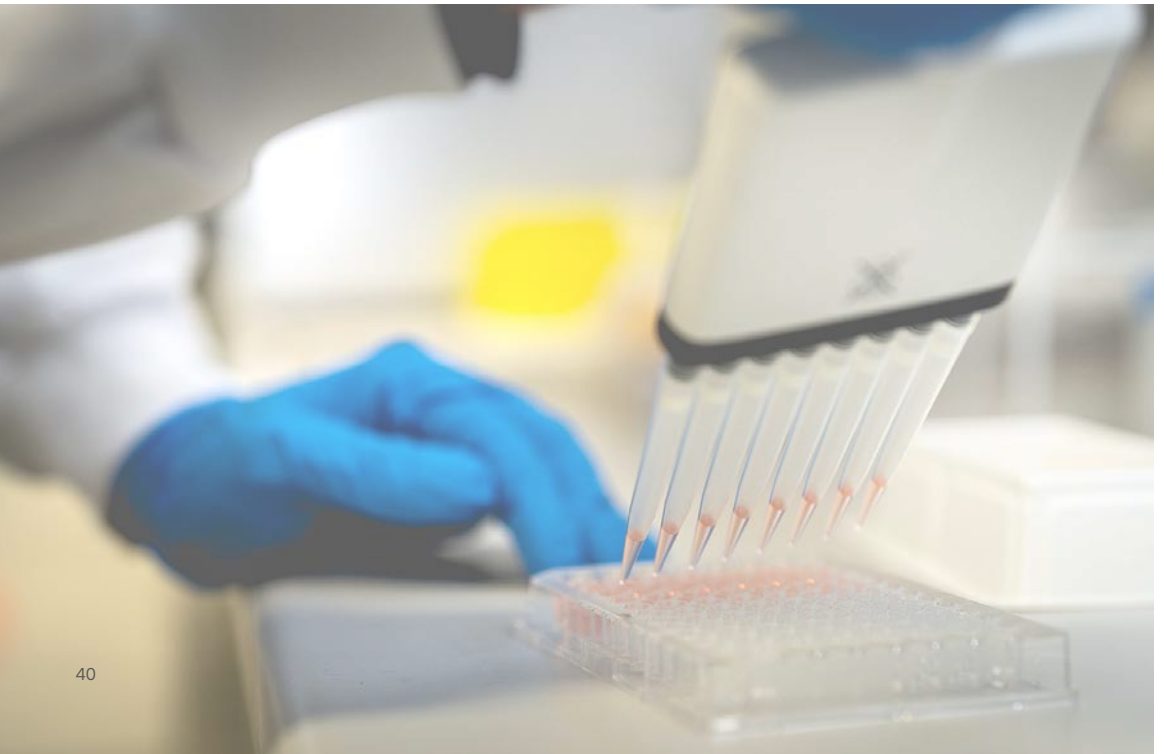
Publication Highlights in 2024

The search for non-evoked markers of pain in the GTN mouse model of migraine. Clement A, Dam-Amby CL, Obelitz-Ryom K, Christensen SL. Sci Rep. 2024;14(1):26481.10.1038/s41598-024-78332-3

VPAC1 and VPAC2 receptors mediate tactile hindpaw hypersensitivity and carotid artery dilatation induced by PACAP38 in a migraine relevant mouse model. Guo S, Rasmussen RH, Hay-Schmidt A, Ashina M, Asuni AA, Jensen JM, et al. J Headache Pain. 2024;25(1):126.10.1186/s10194-024-01830-2

Editor:
Sarah Louise Christensen is editorial board member of Headache Medicine.

Other activities:
Jes Olesen has established two publication awards (20.000 Euros each) to be awarded first time in 2025 in collaboration with the European Academy of Neurology and International Headache Society.



MOLECULAR MIGRAINE & PAIN TRIGGERS

Principal Investigator: Håkan Ashina



Senior Scientist & Physician,
Copenhagen University
Hospital – Rigshospitalet

Our lab aims to map the molecular and cellular underpinnings of migraine and other pain disorders to pave the way for new avenues in drug discovery. To achieve this, we use state-of-the-art techniques, including in vivo electrophysiological recordings from meningeal nociceptors in rodents and headache provocation modelling in humans. Our goal is to pinpoint the fundamental molecular and cellular mechanisms driving migraine attacks and other types of pain, with a particular focus on the activation of ascending trigeminal pain pathways, a critical driver of headache pathophysiology. Through our translational approach, we aim to reduce the global burden of migraine and pain disorders by deepening our understanding of their neurobiological origins and identifying novel therapeutic targets.

Haidar M. Al-Khazali, MD, Postdoctoral Fellow



Funded by Rigshospitalet Research Foundation.
The research focussed on identifying molecular triggers of migraine and headache through provocation modelling in humans, leveraging these insights to propose novel drug targets for exploration.

Rune H. Christensen, MD, PhD Fellow,



Funded by Rigshospitalet Research Foundation
The research explores the mechanisms of molecular migraine triggers through electro-physiological recordings from meningeal nociceptors in rodents. Furthermore, I investigate structural and functional alterations in migraine and post-traumatic headache using advanced magnetic resonance imaging.

Berkay Alpay, MD, PhD, Postdoctoral Fellow



Funded by Lundbeck Foundation.
The research maps peptidergic migraine triggers in humans using headache provocation modelling and investigates their mechanisms of action through electrophysiological recordings from meningeal nociceptors in rodents.

Publication Highlights in 2024

Hypersensitivity to PACAP-38 in post-traumatic headache: a randomized clinical trial. Al-Khazali HM, Christensen RH, Dodick DW, Chaudhry BA, Amin FM, Burstein R, et al. Brain. 2024;147(4):1312-20.10.1093/brain/awad367
Pituitary adenylate cyclase-activating polypeptide signalling as a therapeutic target in migraine. Ashina H, Christensen RH, Hay DL, Pradhan AA, Hoffmann J, Reglodi D, et al. Nat Rev Neurol. 2024;20(11):660-70.10.1038/s41582-024-01011-4

Editor:
Editorial Board Member of The Journal of Headache and Pain.

Other activities:
Rigshospitalet Research Foundation & Lundbeck Foundation.

MULTIPLE SCLEROSIS RESEARCH

Principal investigator – Jette Lautrup Frederiksen



MD, DMSc. Professor
Department of Neurology,
Rigshospitalet and University
of Copenhagen

Principal investigator – Gunnar Houen



MSc, PhD, DSc. Research associate
Department of Neurology,
Rigshospitalet and professor
at Department of Biochemistry
and Molecular Biology, SDU

The research group focuses on the immunology of multiple sclerosis (MS) and related disorders, including optic neuritis, myelin oligodendrocyte glycoprotein-associated disease (MOGAD) and neuromyelitis optica (NMO). This translational research focuses on the interplay of predisposing genetic factors and environmental factors examining patients from our clinical research group at Department of Neurology. Especially the role of Epstein-Barr Virus as a major and necessary driver of the central nervous system inflammation in MS has been investigated. Based on this, we are now focusing on the interplay of EBV with the immune system in relation to disease aetiology, diagnosis, treatment and prognosis.

Nicole Hartwig Trier – Post. Doc.



Funding by Rigshospitalet. The research focuses on the role of Epstein-Barr Virus and other viruses in MS and MOGAD.

Kirsten Beth Hansen – Laboratory technician



The research focuses on the role of Epstein-Barr Virus and other viruses in MS and MOGAD.

Richardt Jack Vognstoft, MSc student,



University of Southern Denmark. The research focuses on the role of Epstein-Barr Virus and other viruses in MS, ON and other auto-immune diseases.

Publication Highlights in 2024

Subcortical plaques and inflammation reflect cortical and meninge-al pathologies in progressive multiple sclerosis. Okutan B, Frederiksen JL, Houen G, Sellebjerg F, Kyllesbech C, Magyari M, et al. Brain Pathol. 2025;35(3):e13314.10.1111/bpa.13314

Epstein-Barr nuclear antigen 1 antibody-based indices are increased in patients with multiple sclerosis. Ali R, Trier NH, Houen G, Frederiksen JL. Mult Scler Relat Disord. 2024;92:106173.10.1016/j.msard.2024.106173.

NEURO GENOMICS

Principal Investigator – Associate Professor Thomas Folkmann Hansen MSc PhD



Senior Researcher
Rigshospitalet, Copenhagen University Hospital:
Danish Headache Center
Danish Multiple Sclerosis Center
Translational Research Centre

Associate Professor
Novo Nordisk Foundation Research Center for Protein Research, Copenhagen University

The NeuroGenomic Group specializes in genetics and genomics research, focusing on deciphering the complexities of the human genome and its role in neurological disorders. Utilizing a systems biology approach, the group strives to understand the disease mechanisms underlying neurological conditions. The research is further enhanced by a commitment to translational approaches, with the ultimate aim of advancing precision medicine in the field of neurology. The group has extensive experience with setting up biobanks, both clinical and population based, for deep phenotyping and multiomic sampling. his is exemplified by the group's most recent initiative, Cyclome.dk, which aims to generate the first comprehensive atlas of the natural biological variability across the menstrual cycle.

The group is based at the Translational Research Centre, the team is affiliated with the Danish Multiple Sclerosis Center (DMSC), the Danish Headache Center (DHC), and the Health Data Science and AI at Copenhagen University.

Lisette Kogelman – Associate Professor MSc, PhD



With a strong background in biostatistics and bioinformatics, Dr. Kogelman has contributed to several genomic studies, including next-generation sequencing of familial migraine, spontaneous migraine attacks, and treatment efficacy. Dr. Kogelman is currently focused on women Health assessing the genetic epidemiology of endometriosis and menstrual migraine, both is as senior researcher also involved in the group activity exploring comorbidity and disease trajectories in neurological disorders.

Isa Amalie Olofsson – MD, PhD, BRIDGE Post Doc



Dr. Olofsson has a medical background with a strong focus on translational science. She employs novel approaches to investigate fundamental aspects of headaches, such as defining and studying individuals who have never experienced a headache in their lifetime and examining monozygotic twins discordant for migraine using long-read sequencing.

Mona Ameri Chalmer – MD, PhD, Part-Time Post Doc



Dr Chalmer has almost 10 years of research experience with clinical and genetics of migraine and is currently chair of The Lundbeck Foundation Investigator Network and future residence as a neurologist.

Tanya Ramdal Techlo – MSc, PhD-Student



MsC. Techlo, is a bioinformatician working on different aspect of next-generation sequencing with the focus on advancing pedigree analyses. She has a focus on both developmental disease like epilepsy and common neurological disease like migraine.

Olafur B. Davidsson – MSc, PhD, Biostatistician



The research focuses on migraine, including triptan consumption from 1994 to 2019, and the correlations between migraine, preeclampsia risk, and childhood cancer. It aims to develop predictive models for triptan efficacy, requiring further genetic studies on migraine

Publication Highlights in 2024

Trigeminal neuralgia and its comorbidities: a nationwide disease trajectory study. Worm J, Jørgensen IF, Davídsson Ó B, Hjalgrim H, Röder T, Ostrowski SR, et al. Pain. 2025;166(4):879-87.10.1097/j.pain.0000000000003428

Genome-wide association study reveals a locus in ADARB2 for complete freedom from headache in Danish Blood Donors. Olofsson IA, Kristjansson RP, Callesen I, Davidsson O, Winsvold B, Hjalgrim H, et al. Commun Biol. 2024;7(1):646.10.1038/s42003-024-06299-y

Consortia

- Danish Blood Donor Study [DBDS]: Steering Member
- Danish Blood Donor Study Genomic Consortium [DBDS-GC]: Co-PI
- Copenhagen Hospital Biobank [CHB-degen, CHB-brain]: Protocol member on neurological disorders
- International Headache Genetics Consortium [IHGC]: Deputy Chair
- Collaboration on Cluster Headache Genetics [CCG]: PI
- National Multiple Sclerosis Biobank. Co-founder

Current Funding

Independent Research Council: The Cyclome (DFF Project 2), in collaboration with SSI (Prof. Mette Nyegaard) and Hvidovre Hospital (Prof. Henriette S Nielsen). PI: Hansen

Independent Research Counsel: The cyclome (DFF Project 1), in collaboration with Copenhagen University (Prof. Eva Hoffmann) and deCODE genetics, Iceland. PI: Olofsson

BRIDGE Post Doc, Isa Olofsson, in collaboration with Copenhagen University (Prof Eva Hoffman) and deCODE Genetics (Gyda Björnsdottir). PI: Hofmann

BRIDGE Post Doc, Isa Olofsson, in collaboration with Copenhagen University (Prof Eva Hoffman) and deCODE Genetics (Gyda Björnsdottir)

Candy's Foundation, PI Jes Olesen

NVRU-B / BASIC NEUROVASCULAR AND NEUROREHABILITATION RESEARCH

Principal Investigator – Christina Kruuse



Clinical Professor,
Department of Brain and Spinal Cord Injury Copenhagen University Hospital, and Department of Clinical Medicine, University of Copenhagen

Our translational research group NVRU addresses basic mechanisms of neuronal and neurovascular signaling in health and neurological diseases. We focus on stroke, traumatic brain- and spinal cord injury. We work from bench to bedside and back, aligning findings in preclinical studies to implementable treatments in neurovascular disease and improving neurorecovery after brain and spinal cord injury. We specialize in repurposing drugs for use in neurovascular disease or neuronal injury for ease of applicability in the clinical practice.

NVRU-B, established in TRACE in 2023, is a part of the clinical NVRU group allocated to Dept of Brain and Spinal Cord Injury, Rigshospitalet, formerly at Dept of Neurology Herlev Gentofte Hospital.

The current pre-clinical projects focus on vascular and neuroinflammatory effects of treatment modifying cellular cyclic nucleotide signaling regulated by phosphodiesterases (PDE) in an animal stroke model and blood from humans. Pre-existing or induced neuroinflammation may be a key component involved in both detrimental and restorative mechanisms in stroke, and modifying the response may improve recovery. The animal stroke models are currently done in collaboration with Professor Kate Lambertsen, Neurobiology Research Unit, Odense SDU, but will be further evolved and established at TRACE. We further benefit from the close interaction with other key groups at TRACE on cellular signalling and RNA analysis.

Group members currently involved in translational research:

Nina Steen Vindegaard Sørensen – Post doc, MD



The overall research focus is post-stroke immunological alterations and the immune system as treatment target in neurorehabilitation after stroke - in this specific project investigations of phosphodiesterase in a stroke model.

Publication Highlights in 2024

The effect of robot-assisted versus standard training on motor function following subacute rehabilitation after ischemic stroke - protocol for a randomised controlled trial nested in a prospective cohort (RoboRehab). Skovgaard Jensen J, Sørensen AS, Kruuse C, Nielsen HH, Skov CD, Jensen HB, et al. BMC Neurol. 2024;24(1):233.10.1186/s12883-024-03734-9

Upper-extremity motor recovery after stroke: A systematic review and meta-analysis of usual care in trials and observational studies. Kolmos M, Munoz-Novoa M, Sunnerhagen K, Alt Murphy M, Kruuse C. J Neurol Sci. 2025;468:123341.10.1016/j.jns.2024.123341.

Funding
Læge Sofus Carl Emil Friis og hustru Olga Doris Friis' Legat.

REPRODUCTIVE HORMONE RESEARCH

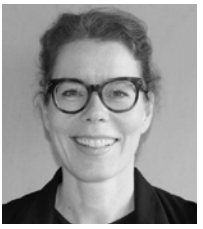


Principal Investigator – Line Rode



Senior researcher
PhD, MD

Principal Investigator –Trine Holm Johannsen



Senior researcher
PhD, MD

This research group focuses on applying biochemical markers to improve prediction, diagnostics, and treatment in the fields of reproduction and sexual development. Through interdisciplinary collaboration, the group bridges clinical biochemistry with clinical specialties such as fetal medicine, obstetrics, pediatrics, and endocrinology.

The group aims to identify pregnant women at high risk of fetal and obstetric complications. With a particular emphasis on early prediction during pregnancy, the goal is to develop and implement screening algorithms that integrate biochemical markers, enabling individualized prenatal care based on each woman's risk profile. This approach facilitates targeted prevention and treatment, optimizing outcomes

for both mother and child. The research is grounded in extensive prospective cohort studies, clinical randomized trials, and epidemiological analyses.

Additionally, the group focuses on Differences of Sex Development (DSD), aiming to characterize biochemical markers to improve the diagnosis and treatment of patients with DSD. This research includes establishing reference ranges for biomarkers and correlating biomarker levels with the clinical status of affected patients.

The research team comprises senior researchers Line Rode (consultant, PhD) and Trine Holm Johannsen (consultant, PhD), a human biologist, a PhD student, as well as bachelor and master's students. The team is part of a broader interdisciplinary network working to generate new knowledge and improve treatment options in the fields of reproduction and sexual development.

Mille Kirk (previously Taagaard) – **Midwife and MSc in Human Biology**



Funding by Rigshospitalet's Research Fund, Introductory scholarship 2023-2024.
Mille's research is focused on assessing first-trimester biomarkers associated with spontaneous preterm birth and identifying maternal risk factors for the condition. The aim is to integrate these factors into a first-trimester prediction model for spontaneous preterm birth.

Supervision of PhD students

Co-supervisor for midwife Nina Nathan. UCPH. Main supervisor: Professor Hanne K Hegaard. Project title: Labour dystocia and augmentation – predictors and prevention. Thesis defended June 2024.

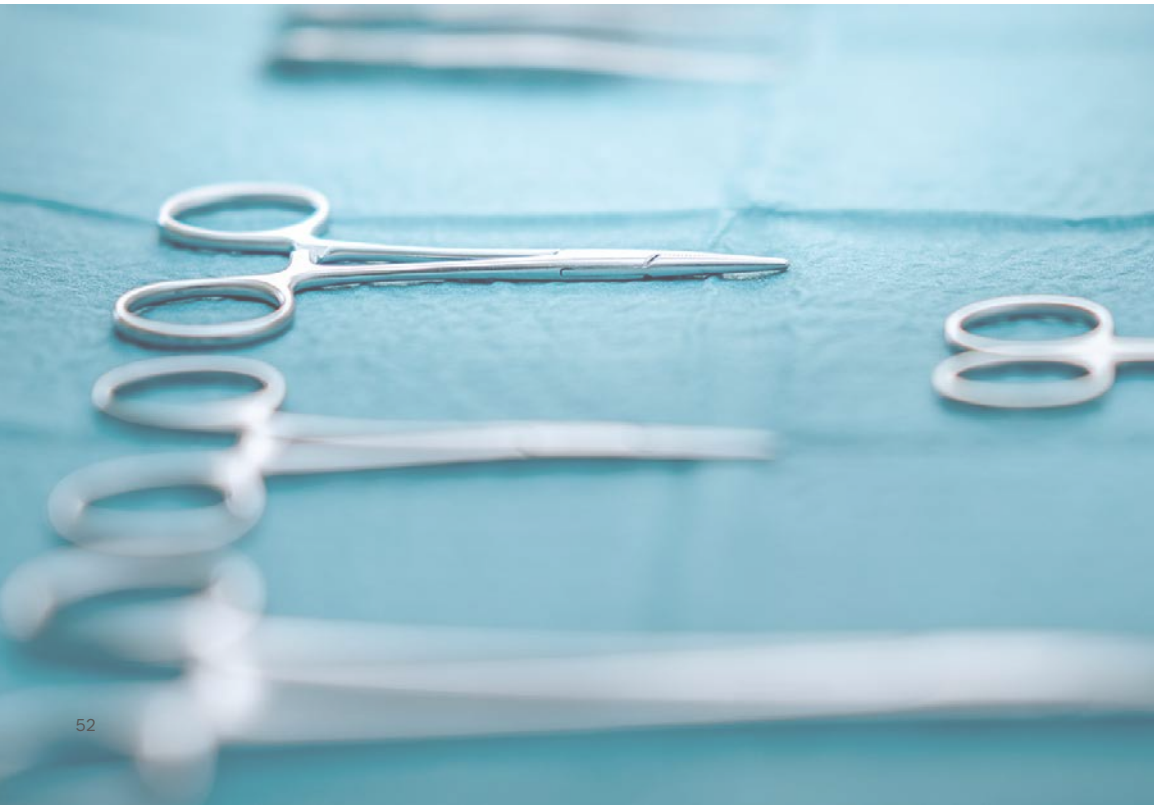
Publication Highlights in 2024

Inflammatory markers in relation to maternal lifestyle and adverse pregnancy outcomes in twin pregnancies. Christiansen CH, Kirk M, Worda K, Hegaard HK, Rode L. J Reprod Immunol. 2024;164:104286.10.1016/j.jri.2024.104286

Screening for pre-eclampsia with competing-risks model using placental growth factor measurement in blood samples collected before 11 weeks' gestation. Riishede I, Ekelund CK, Sperling L, Overgaard M, Knudsen CS, Clausen TD, et al. Ultrasound Obstet Gynecol. 2024;63(3):342-9.10.1002/uog.27462

Editor:
Associate editor of The Journal of the Danish Medical Association.

Funding:
Rigshospitalet's Research Fond, Introductory Scholarship 2023-2024. Congress fee funding by Lundbeckfonden and The Danish Association of Midwives. Funding for data extraction by The Danish Association of Midwives.



RNA THERAPEUTICS



Principal Investigator – Anja Holm



Senior researcher
TRACE

Associate Professor
Section for Cell and Drug Technologies,
Department of Health Technologies,
Technical University of Denmark

Our research group focuses on translational RNA therapeutics, particularly the development of antisense oligonucleotide (ASO) therapies to modulate gene expression in metabolic, inflammatory, and neurological diseases. We investigate how RNA-targeted therapies influence disease mechanisms at the molecular level, with an emphasis on precision medicine and clinical translation.

A key area of our work is ASO therapy for migraine, where we study molecular pathways involved in neurovascular regulation to explore more effective and long-lasting treatment options. Our research integrates in silico design, in vitro screening, and in vivo models to optimize ASO delivery and efficacy. With a focus on clinical application, we aim to translate fundamental discoveries into new therapeutic approaches, with broader applications in neuroinflammation, obesity, osteoarthritis, and vascular dysfunction. We take an interdisciplinary approach and welcome opportunities to explore new avenues where RNA therapeutics may have an impact.

Other Research Focus Areas
In addition, our group examines the role of sex hormones and epigenetic regulation in disease susceptibility, particularly in hormone-related disorders such as migraine. We investigate how hormonal fluctuations influence gene expression and contribute to neurological and metabolic conditions, providing insights that may help guide future treatment strategies.

Kine Stamp-Larsen, project student



Center for RNA Medicine, Department of Clinical Medicine, Aalborg University

The research focuses on establishing an in vitro migraine model. By stimulating cells expressing the CGRP encoded gene CALCA with different concentrations of female sex hormones and analyzing the levels of genes involved in the CGRP-system on both RNA and protein levels.

Sofia Setareh Abtahi, Master student



Department of Pharmacology, University of Copenhagen. The research focuses on identifying new potential targets for treating menstrual migraine. These targets could be tested experimentally in relevant migraine models to assess their efficacy.

Valentina Aagaard Cerenzia, Intern



The research investigates the level of migraine related proteins in the trigeminal ganglion from mice treated with female sex hormone

Co-supervised students
PhD student Simone Tomasini (Center for RNA Medicine, Department of Clinical Medicine, Aalborg University)

Publication Highlights in 2024

VPAC1 and VPAC2 receptors mediate tactile hindpaw hypersensitivity and carotid artery dilatation induced by PACAP38 in a migraine relevant mouse model. Guo S, Rasmussen RH, Hay-Schmidt A, Ashina M, Asuni AA, Jensen JM, et al. J Headache Pain. 2024;25(1):126.10.1186/s10194-024-01830-2

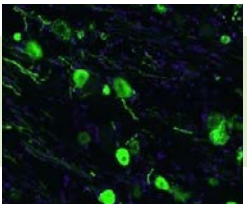
Protein kinase C-inhibition reduces critical weight loss and improves functional outcome after experimental subarachnoid haemorrhage. Bömers JP, Holm A, Kazantzi S, Edvinsson L, Mathiesen TI, Haanes KA. J Stroke Cerebrovasc Dis. 2024;33(7):107728.10.1016/j.jstrokecerebrovasdis.2024.107728.

Other accomplishments in 2024

Management course, Research Leadership, Capital Region, Copenhagen, Denmark, 2024

Entrepreneurship course, Innovation and Commercialization in Life Sciences, Bio Innovation Institute, Copenhagen, Denmark, 2024

SENSORY BIOLOGY



Principal Investigator – Kristian A. Haanes



Senior researcher and Associate Professor
Department of Biology,
Copenhagen University Hospital

Our team's research investigates the physiological roles of sensory nerves, focusing on neurons within the trigeminal ganglion that play a key role in pain transmission, crucial for understanding migraines and other primary headaches. We study these neurons' mechanisms for transmitting signals, adapting to changes, and protecting against damage, with a focus on the pathophysiology of migraine and related sensory disturbances. Additionally, our work includes examining the blood vessels these nerves innervate to find ways to improve resistance to ischemic injuries, such as those caused by strokes. Our examination of the trigeminovascular system seeks to understand its influence on neurovascular innervation and sensory dysfunctions, with an emphasis on pain processing. The research encompasses the system's role in supplying blood to cerebral arteries and the dura mater, providing insights into stroke, glaucoma, and migraine. An important part of our study is Calcitonin Gene-Related Peptide (CGRP), for its vasodilatory effects and its potential in treating ischemic conditions.

Karin Maria Löfgren Nordahl – Post Doc



Funding by the Lundbeck foundation.
The research focuses on exploring the therapeutic implications of neuropeptides in the treatment of glaucoma and elucidating their role in the pathophysiology of cluster headaches.

Philip Victor Reducha – PhD Student / Post Doc



Funding by the Lundbeck foundation
The research focuses on investigating the roles of inflammation, neuropeptide release, and transient receptor potential (TRP) channels in the pathophysiology of migraine.

Spyridoula Kazantzi – 3nd year PhD



Funding by Rigshospitalet.
The research investigates the role of arterial cellular differentiation in cardiovascular disease and arteriosclerosis, utilizing myograph techniques and arterial contraction measurements.

Jens Bjelke Kristensen -2nd Year PhD



Funding by Innovation Foundation Industrial PhD - Gubra.

The research explores the connection between migraine and cardiovascular diseases, integrating the roles of neuropeptides and peptide antagonists in the underlying mechanisms.

Mette Nyholm Jensen –2nd year PhD



Funding by the Lundbeck foundation.
The research investigates the role of neuropeptides and neural pathways in migraine pathophysiology, with an additional focus on the influence of sex hormones.

Jesper Peter Bömers – MD.PhD



Department of Neurosurgery
Research focuses on inflammation as a factor in migraine, with modulation of signaling pathways. Further the link between subarachnoid haemmorage and the use of CGRP antibodies is under investigation.

Sofia Lyng Wæver – Student assistant/BSc student



Funding by the Lundbeck foundation.
The research investigates neuropeptide expression with mouse models and immunohistochemistry, focusing on the differential localization and vesicular sorting of αCGRP and βCGRP.

Lukas Kristian Svane Nielsen – Biology Master student



The research investigates TRP channels in the trigeminal ganglion and calcium signalling in trigeminal neurons expressing a genetically encoded calcium sensor under the CGRP-induced Cre system, with additional focus on optimizing experimental setup. Co-supervisor Philip V Reducha.

Lukas Knigge Laursen – Biology Master student



The research investigates purinergic receptors in the trigeminal ganglion and calcium signalling in trigeminal neurons expressing a genetically encoded calcium sensor under the CGRP-induced Cre system. Co-supervisor Philip V Reducha.

Camilla Ploug Koksby Hansen – Biochemistry Bachelor student



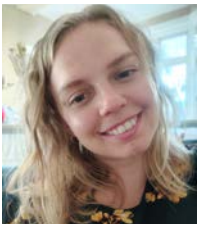
The research focuses on the expression of ion channels in the dura mater in relation to migraine, with particular emphasis on mechanisms of water transport. Co-supervisor Mette Nyholm.

Bjarke Skovgaard Hansen – Veterinary Master student



The research focuses on establishing and optimizing the light-dark box method to assess behavioural sensitivity following intravenous CGRP injections, with emphasis on behavioural outcomes. Supervisor Karin ML Nordahl.

Veronika Krogh – Veterinary Master student



The research focuses on establishing and optimizing the light-dark box method to assess behavioural sensitivity following intravenous CGRP injections, with emphasis on behavioural outcomes. Supervisor Karin ML Nordahl.

Co-supervised students

PhD student M Emelie Pitkänen Fungbrant, MD (Experimental Neurosurgery), PhD student Christina Kamp-Jensen (BRAWA), and Master student Tanja Lylloff (BRAWA).

Publication Highlights in 2024

The impact of the migraine treatment onabotulinumtoxinA on inflammatory and pain responses: Insights from an animal model. Reducha PV, Bömers JP, Edvinsson L, Haanes KA. Headache. 2024;64(6):652-62.10.1111/head.14726

Protein kinase C-inhibition reduces critical weight loss and improves functional outcome after experimental subarachnoid haemorrhage. Bömers JP, Holm A, Kazantzi S, Edvinsson L, Mathiesen TI, Haanes KA. J Stroke Cerebrovasc Dis. 2024;33(7):107728.10.1016/j.jstrokecerebrovasdis.2024.107728

Editorial work

Associate Editor for Journal of Headache and Pain.

Funding

Thanks to the Lundbeck foundation and Innovation foundation for funding.



VIPER / VISUAL PATHWAY RESEARCH

Principal Investigator – Steffen Hamann



Clinical Research Associate Professor
Department of Ophthalmology,
Copenhagen University Hospital,
and Department of Clinical Medicine,
University of Copenhagen

Our research group has two major focus points. The first centers around optic neuropathies, where axonal compression, inflammation and loss of blood supply potentially lead to loss of vision. In particular, we want to understand the underlying pathobiology of increased intracranial pressure states, ischemic optic neuropathies, and optic disc drusen. In this focus point we perform clinical studies and patient trials on patients with optic neuropathies, and translational research, where we in rodent models investigate the effect that raised intracranial pressure or other equivalents to human disease have on the retina and optic nerve. We also perform basic studies focusing on osteoclast activity on histological specimen of optic disc drusen in order to ultimately develop a treatment for this disease based on a decalcification principle.

Our second major focus point is oculomics – the study of the eye as a biomarker for systemic disease – with a particular focus on brain disease. Here we employ advanced artificial intelligence-based, multimodal deep phenotyping of the retina and optic nerve as a proxy for early and accurate diagnosis of neurologic disease, often detectable even before the onset of symptoms. Informed by the results from these, mainly clinical studies, our goal in the near future is to set up a translational arm, using OCT-based deep phenotyping of the retina and optic nerve looking for signatures of brain disease in animal models.

Group members currently involved in translational research:

Snorre Malm Hagen, PhD student, MD



Research focusing on optic nerve and retinal signatures of raised intracranial pressure in rodent models. Defended his PhD thesis in 2024.

Josephine Mejdahl Bentin, MD



Former masters student. Performed basic studies on the effect of osteoclasts targeting the calcificied property of optic disc drusen in histology specimen.

Publication Highlights in 2024

Optic disc drusen: Dystrophic calcification, a potential target for treatment. Bentin JM, Heegaard S, Jørgensen NR, Grahnemo L, Hamann S. Eye (Lond). 2024;38(12):2359-64.10.1038/s41433-024-03138-6

Application of novel non-invasive ophthalmic imaging to visualize peripapillary wrinkles, retinal folds and peripapillary hyperreflective ovoid mass-like structures associated with elevated intracranial pressure. Graven-Nielsen M, Dubra A, Dodd RL, Hamann S, Moss HE. Front Neurol. 2024;15:1383210.10.3389/fneur.2024.1383210

Other Group members
Lasse Malmqvist, MD, PhD, Alvilda Steensberg, MD, PhD Student, Elisabeth Wibroe, MD, PhD Student, Michael Stormly Hansen MD, PhD Student, Lea Lykke-birk, MD, PhD Student, Sanja Cejvanovic, MD, PhD Student, Marius Mårtensson, Medical Student, Michaela Graven Nielsen, MD, Junior Scientist, Christopher Maximillian Behrens, MD, Junior Scientist, Morten Jørgensen, MD, Junior Scientist, Andreas Worm Bendtsen, MD, Junior Scientist

Academic engagement 2024
Editor: Steffen Hamann is Associate Editor on Neuro-Ophthalmology (Taylor & Francis)

Consortia: Steffen Hamann is the founder and chair of the international Optic Disc Drusen Studies (ODDS) Consortium and leader of the neuro-ophthalmology workgroup in the EU supported European strategical reference network for rare eye diseases ERN-EYE

Other committees: Steffen Hamann is leading the International Relations Committee of NANOS (North American Neuro-Ophthalmology Society)

Funding
Thanks to the VELUX Foundation, Rigshospitalet Research Foundation, Synoptik Foundation, and Øjenforeningen

PhDs defended



EPIDEMIOLOGICAL EXAMINATIONS OF MIGRAINE, TREATMENT, AND RISK MODULATING DISORDERS

Ólafur Birgir Davíðsson
Defended 1st of March, 2024

Migraine is a highly prevalent neurological disorder associated with significant personal and societal burden. Although effective treatments exist, treatment efficacy varies substantially between individuals, and the presence of comorbidities or risk factors may further complicate management. The aim of Ólafur's thesis was to improve the understanding of migraine pathophysiology and epidemiology through large-scale population-based studies, with a particular focus on treatment response and comorbid conditions.

Ólafur performed four independent studies using Danish national registers and cohort datasets, including the Danish Blood Donor Study. In the first study, nationwide data on triptan use from 1994 to 2019 were analysed. The results demonstrated substantial gender differences in treatment initiation and persistence, and also identified widespread discontinuation despite the availability of multiple triptan formulations. The second study investigated predictors of triptan treatment response using machine learning models and polygenic risk scores. It was shown that menstruation-related migraine predicted better outcomes, while migraine with aura and visual disturbances were associated with poorer response. A higher genetic risk for migraine without aura predicted better treatment efficacy.

The third study evaluated migraine as a long-term sequela of childhood cancer. Using prescription and hospital data, Ólafur found an increased risk of migraine among cancer survivors, particularly in those diagnosed during late adolescence. The fourth study investigated the bidirectional association between migraine and preeclampsia using both registry and cohort data. Migraine was associated with an increased risk of preeclampsia, and vice versa, although no shared genetic predisposition was identified.

Primary Supervisor
Associate Professor Thomas Folkmann Hansen, PhD
University of Copenhagen / Rigshospitalet

Primary Co-supervisor
Henrik Hjalgrim, MD, PhD, DMSc
Danish Cancer Institute / Statens Serum Institut

Co-supervisor
Associate Professor Lisette Kogelman, PhD
Aalborg University

Assessment Committee

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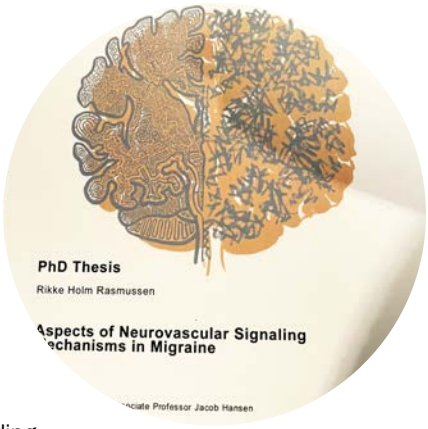
Prof. Majken Karoline Jensen, PhD
University of Copenhagen

Opponents
Prof. Arn van den Maagdenberg, PhD
Leiden University, Netherlands

Prof. Wesley Thompson, PhD
University of California, San Diego, USA



ASPECTS OF NEUROVASCULAR SIGNALING MECHANISMS IN MIGRAINE



Rikke Holm Rasmussen
Defended 5th of March, 2024

Migraine is a common primary headache disorder affecting 15% of the global population, yet its underlying mechanisms remain poorly understood, especially regarding environmental influences. My PhD research focused on unraveling signaling pathways involved in migraine using mouse models of provoked migraine, as well as investigating the interactions between environmental pollutants and migraine-associated signaling.

The work of this PhD thesis spans various experimental approaches, including calcium imaging, electrophysiology, ex vivo tissue studies, and behavioral in vivo assessments which in combination with transgenic mouse strains and pharmacologic agents, have been used to examine signaling pathways associated with migraine pain. The research sought to investigate signaling pathways involved in mouse models of provoked migraine and examine how environmental chemicals could interfere with these migraine-associated pathways. The studies revealed that nitroglycerin-induced hypersensitivity depends on the TRPA1 ion channel, while hypersensitivity caused by levcromakalim and cilostazol is mediated by CGRP through more complex mechanisms. Additionally, the ATP-sensitive potassium channel subunit Kir6.1 was found to play a crucial role in vascular and sensory responses associated with migraine. Finally, the research uncovered a significant link between environmental pollutants and migraine signaling. 31% of the pollutants screened activated TRPA1. The pesticide pentachlorophenol was further shown to induce CGRP release, dilate blood vessels, and cause cutaneous hypersensitivity in mice. This work provides new insights into migraine signaling pathways, emphasizes the involvement of the vasculature, and sheds light on how environmental factors may contribute to migraine.

Principal Supervisor:
Associate Professor Jacob Hansen
University of Copenhagen

Co-Supervisor:
Professor David M. Kristensen,
Roskilde University

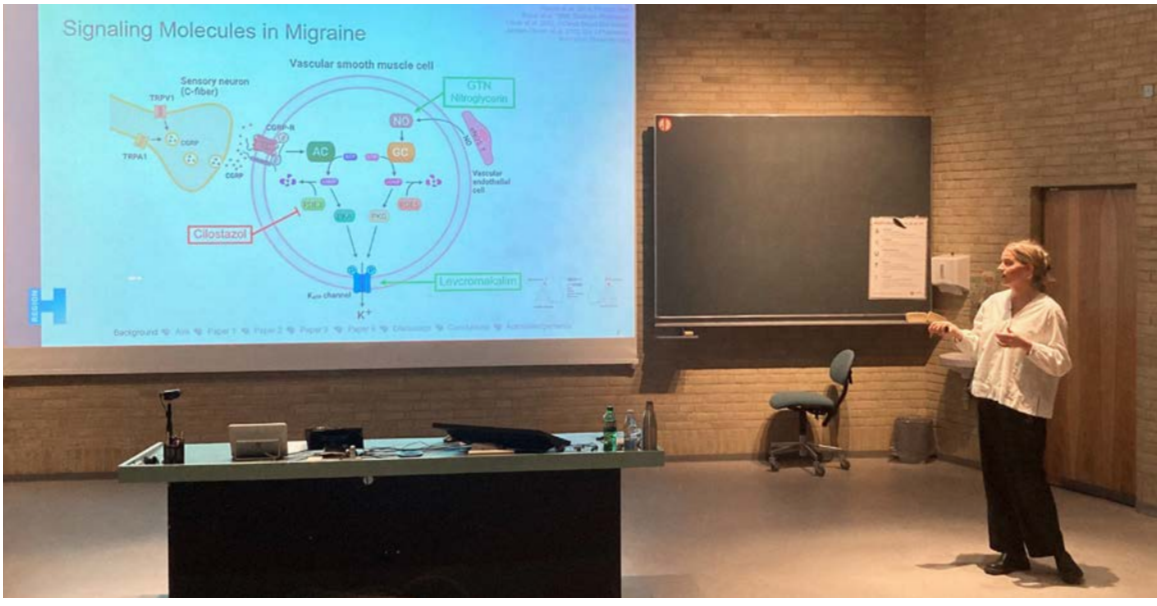
Co-Supervisor:
Senior Scientist Sarah L. Christensen,
DVM, PhD,
Rigshospitalet, TRACE

Assessment Committee

Chairperson
Professor Lotte Bang Pederesen
University of Copenhagen

Opponents
Professor Terje Svingen
Technical University of Denmark,
Denmark

Professor Gregory Dussor
University of Texas at Dallas, USA





THE MECHANISMS BEHIND IDIOPATHIC INTRACRANIAL HYPERTENSION: The role of obesity, sex and potential cofactors in the regulation of intracranial pressure

Ida Marchen Egerod Israelsen
Defended 19st of April, 2024

Idiopathic intracranial hypertension (IIH) is a rare disease that predominantly afflicts young obese women. IIH is a disease of raised intracranial pressure (ICP). However, the causes underlying the raised ICP remain unelucidated. Many factors such as biological sex and steroid hormone dysfunction have all been proposed to be pathogenic in IIH, but it has yet to be experimentally assessed.

Using pre-clinical models, the effects of three co-factors on the regulation of ICP and the choroid plexus, the organ that secretes the majority of cerebrospinal fluid. Ida demonstrated that the point in the estrus cycle, rather than biological sex, dictates the expression of key CSF secretary genes at the choroid plexus. Previous work has demonstrated that adenosine is lower in the serum of IIH patients. This was pharmacologically mimicked by the administration of caffeine which robustly lowered ICP, highlighting that lower adenosine may have a protective role in raised ICP. Moreover, glucocorticoid excess has been demonstrated in IIH patients. Consequently, glucocorticoids were administered, showing that chronic glucocorticoid excess lowers ICP, and that therapeutic glucocorticoids robustly lower ICP for a prolonged period.

Primary Supervisor

Prof. Rigmor Højland Jensen,
MD, DMSc
Rigshospitalet, Danish Headache Centre, TRACE

Primary Co-supervisor
Sajedeh Eftekhari, MSc, PhD
Rigshospitalet, Danish Headache Centre, TRACE

Assessment committee

Chairperson
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Opponents
Reader Jan Hoffmann, MD, PhD
School of Neuroscience, Kings College London

Associate prof. Helle Hasager Damkier,
MD, PhD Institute for Biomedicine,
Aarhus University





IDIOPATHIC INTRACRANIAL HYPERTENSION: Non-invasive monitoring, surgical treatment efficacy and preclinical modelling

Snorre Malm Hagen, MD
Defended 31st May 2024

Idiopathic intracranial hypertension (IIH) is a rare disease that primarily affects young obese women. IIH is a disease of raised intracranial pressure (ICP), which causes papilledema, a swelling of the retina. This can cause irreversible visual loss in many of the patients. The mechanisms that underly this neuroretinal degeneration are poorly understood and the current therapeutic and monitoring strategies are not optimised. Snorre focused on understanding the effects of raised ICP on the retina and clinical assessment of the retina.

Using pre-clinical models, Snorre employed two separate models to assess retinal outcome in raised ICP models. Firstly, using a model of obstructive hydrocephalus, Snorre demonstrate that acute raised ICP can alter the optic disk, resembling features of papilledema. Secondly using a diet-induced obesity model to assess the role of obesity on ICP, Snorre demonstrated that raised ICP was associated with retinal swelling and subsequent retinal degeneration. Snorre also investigated the efficacy of optic nerve sheath fenestration as a therapeutic intervention in IIH, demonstrating that optic nerve sheath fenestration meaningfully improves ophthalmological outcomes in IIH. Finally, Snorre investigated a method for a surrogate marker for raised ICP. Collaborating with the Danish company StatuManu ICP, using machine learning, Snorre demonstrated that the arteriole-to venule diameter ratio can detect raised ICP with high sensitivity and sensitivity.

Primary Supervisor
Assoc. Professor Steffen Hamann, MD, PhD
Department of Ophthalmology, Rigshospitalet

Primary Co-supervisor
Prof. Rigmor Højland Jensen, MD, DMSc
Rigshospitalet, Danish Headache Centre, TRACE

Co-supervisors
Sajedeh Eftekhari, Msc, PhD
Rigshospitalet, Danish Headache Centre, TRACE

Assoc. professor Kåre Fugleholm Buch, MD, DMSc
Rigshospitalet, Department of Neurosurgery

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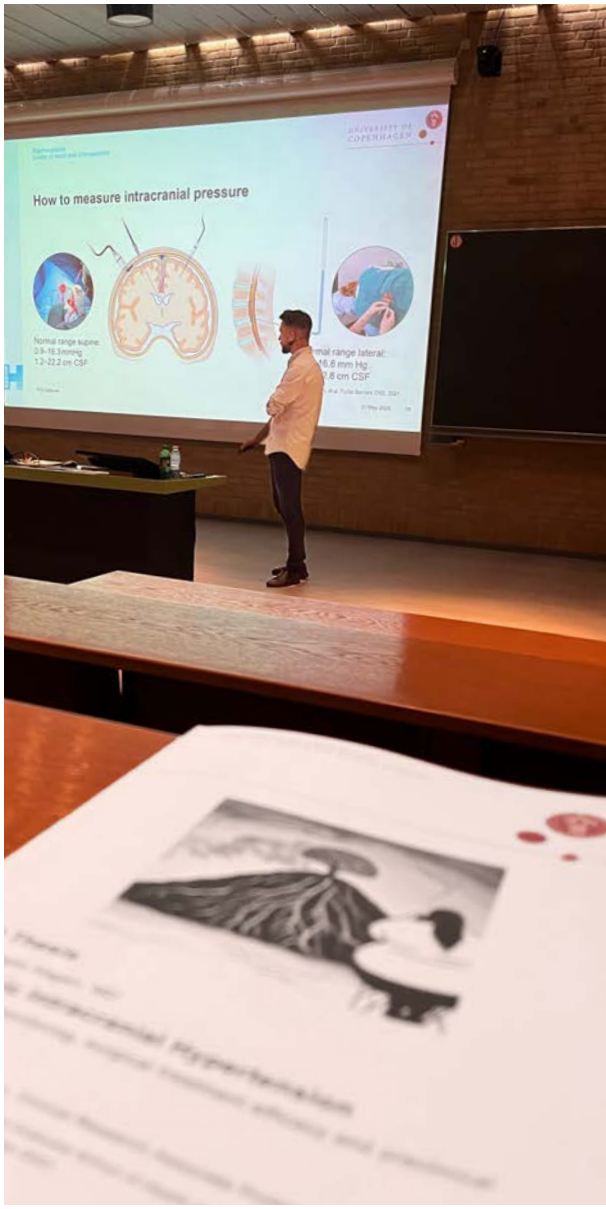
Opponents
Prof. Kathleen Digre, MD

John A. Moran Eye Center, University of Utah

Prof. Henrik Vorum, MD, DMSc, PhD
Aalborg University Hospital



Academic Exchange

Philip Victor Reducha at University of Texas in Dallas

Philip Victor Reducha had the pleasure of completing his exchange in Professor Gregory Dussor's laboratory at the University of Texas in Dallas from January to March 2024. Professor Dussor is a leading expert in pre-clinical pain and migraine research, and his lab has identified several potential molecular targets in migraine pathophysiology, including ASIC channels, TRP channels, IL-6, PAR2, and prolactin. The lab utilizes a variety of preclinical behavioural, electrophysiological, and biochemical models, providing an excellent environment for advanced migraine research.

Philip summed up the exchange experience as follows: "This exchange was a valuable opportunity for me to refine familiar techniques while also learning new skills that I could bring back home. One of the key experiences was learning a minimally invasive dural stimulation model in mice from Dr. Hao Rei. This technique activates dural afferents in the meninges, and I also became proficient in the periorbital von Frey filament test; widely used in migraine research to assess facial mechanical sensitivity, which correlates with allodynia and potential headache-related pain in humans. Additionally, I had the chance to learn a stress model used in the lab that sensitizes mice to exhibit migraine-like behaviours.

Another highlight of my time in the Dussor lab was learning how to culture trigeminal ganglion neurons under the guidance of PhD student Mandee Schaub. This technique is particularly valuable as it enables immunohistochemistry, electrophysiology, and calcium imaging on cell types highly relevant to migraine research.

Beyond the scientific training, I was welcomed with great hospitality by the members of the Dussor lab, which made my experience both enjoyable and seamless. They even taught me a thing or two about being a cowboy! In addition to developing new technical skills, my time in the lab gave me valuable insight into how other migraine research teams operate, broadening my perspective on preclinical migraine science.

”

I am deeply grateful to everyone who made this experience possible, especially my supervisor Kristian, the Dussor lab members, and the University of Texas in Dallas, for their support and for ensuring a smooth and enriching exchange.

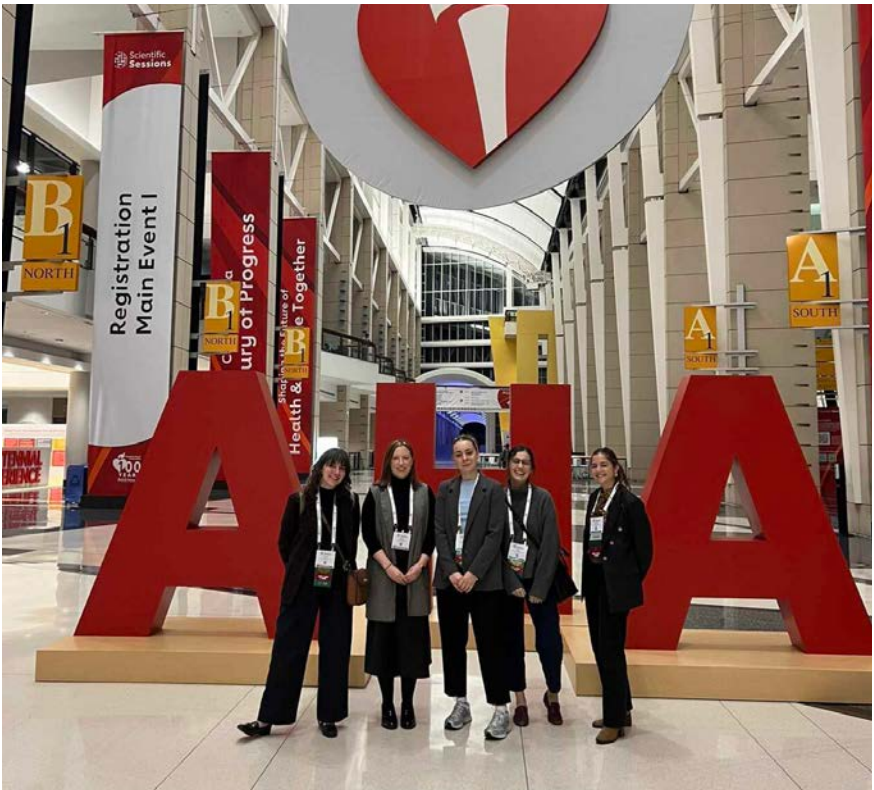


Spyridoula Kazantzi at Center for Interdisciplinary Cardiovascular Sciences (CICS) at Brigham and Women's Hospital and Harvard Medical School

Spyridoula Kazantzi had the incredible opportunity to be a research exchange trainee at the CICS at Brigham and Women's Hospital and Harvard Medical School. This exchange, undertaken as part of her PhD studies and, provided a unique chance to broaden her expertise in advanced cell culture techniques and calcification models, advancing her research on arterial cellular differentiation and cardiovascular disease. The training environment at CICS, known for its interdisciplinary approach and innovation, is an ideal setting.

Spyridoula summed up the exchange experience as follows: "Under the mentorship of Professor Elena Aikawa and the Calcification group, I gained invaluable insights and skills. A special thanks to Dr. Mandy Turner for welcoming me into her projects and for her exceptional guidance throughout this experience. I am also deeply grateful to the entire group for their warm welcome and for fostering such a collaborative and inspiring environment.

Adding to the excitement, I had the privilege of attending the American Heart Association (AHA) Scientific Sessions 2024, where I connected with global leaders in cardiovascular research and showcased our contributions to advancing the field.



”

I have brought back not only advanced skills in cell culture and calcification models, which I am now applying to my ongoing research at TRACE, but also the foundation for continued collaborations with Professor Elena Aikawa, Dr. Mandy Turner, and Dr. Cassandra Clift and as well as the other members of CICS, which will strengthen the international dimension of my research.

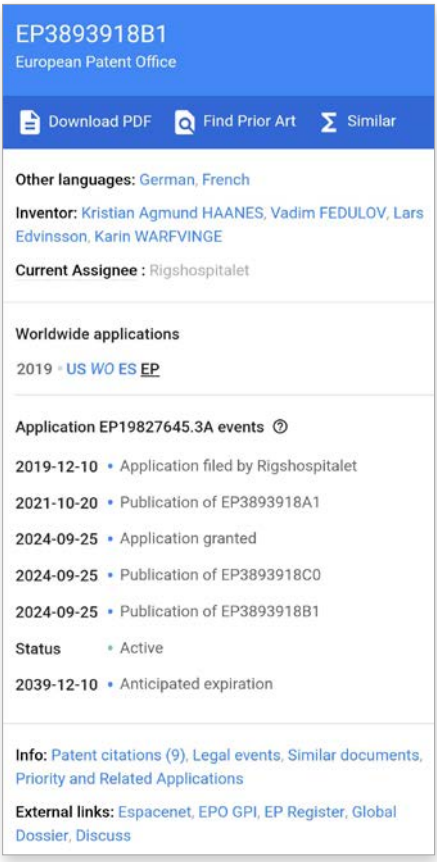


Patent

TRACE is pleased to report that a European patent (EP3893918B1) covering a new treatment strategy for retinal ischemic diseases was granted on September 25, 2024. Patenting is an important part of TRACE activities, supporting both innovation and the translation of research results into new solutions. Although the granting process takes time, this milestone is seen as a major achievement that strengthens ongoing activities and opens opportunities for new collaborations. A corresponding patent application is currently pending in the United States.

The invention, developed by Kristian Agmund Haanes, Vadim Fedulov, Lars Edvinsson, and Karin Warfvinge, was filed on December 10, 2019, with a priority date of December 10, 2018, and is assigned to Rigshospitalet. Development of the project has been supported by the Danish Innovation Foundation through the InnoExplorer program and the Novo Nordisk Foundation through Novo Seeds, with strong institutional support from Rigshospitalet. The patented technology addresses retinal ischemic diseases such as glaucoma and diabetic retinopathy by improving ocular blood flow through localized administration of the vasodilator calcitonin gene-related peptide (CGRP). Preclinical studies demonstrated that CGRP administration reverses blood vessel constriction and restores retinal perfusion, offering a potential strategy to slow or prevent vision loss by addressing the underlying vascular dysfunction rather than only managing symptoms.

We look forward to following the patent towards potential clinical applicability.




Distribution of CGRP and CGRP receptor components in the rat brain
HOLLISTER
CALIFORNIA

Teaching

Scientists at TRACE engage extensively in teaching activities at both national and international higher educational institutions. Their expertise spans various disciplines, including pharmacology, biochemistry, neuroendocrine and environmental health, cell biology, physiology, headache, and neuroscience, as well as health sciences. These teaching activities involve a wide range of programs, courses, and seminars aimed at different academic levels and professional groups. The following list details the specific teaching contributions made by TRACE scientists:

Pharmacology and Biochemistry
RNA Medicine – From Bench to Bedside: PhD Course, Aalborg University

Designing and Evaluating Pharmacological Research: MSc program in Medicine with Industrial Specialization, Aalborg University

Principles of Pharmacology: MSc program in Pharmaceutical Sciences, University of Copenhagen

Organ-related Pharmacology: BSc program in Pharmacy, University of Copenhagen

Courses in Clinical Biochemistry: BMSc and MD programs, University of Copenhagen

Pharmacology and Medicinal Chemistry: Continuous education program for biomedical laboratory scientists and laboratory technicians, University College Copenhagen

Neuroendocrine and Environmental Health
Info meeting on environmental pollutants, Danish Parliament (Christiansborg), Denmark

Society for Pediatric and Perinatal Epidemiologic Research, USA

Immunology
Immunology, Autoimmunology, Cancer Immunology and Infection Immunology courses at University of Southern Denmark

Cell Biology and Physiology
Advanced Cell Biology, Human Anatomy, Human Biology and Evolution: Roskilde University (Master and Bachelor courses)

Cellular and Integrative Physiology, Advanced Topics in Physiology: Master courses, Copenhagen University

Human Physiology (Menneskets Fysiologi): Bachelor course, Copenhagen University

Headache and Neuroscience
Master of Headache Disorder: Faculty of Health, Copenhagen University

Master of Neuroscience (Sensory Systems Module): Faculty of Health, Copenhagen University

Headaches: PhD course, Neuroscience Academy Denmark, Copenhagen University

Master of Headache Disorders: Faculty of Health, Copenhagen University

Summer School in Neuroscience: PhD course, University of Southern Denmark

National Meeting for Association of Young Neurologists, Neurosurgeons, and Neurophysiologists

Lectures on Stroke and Migraine: Monthly lectures for physicians and researchers within universities and healthcare, Lund University

Neuroscience Academy Denmark, Copenhagen University

Health Sciences
Master of Health Science, Integrated Course in the Life Cycle: Faculty of Health, Copenhagen University

Prizes and recognitions

BRAWA / Brain Water, Best Basic Science Prize in the journal 'Headache' awarded for the paper Effects of caffeine on intracranial pressure and pain perception in freely moving rats, authored by Ida Israelsen, Sajedeh Eftekhari, and Connar Westgate et al.

Migraine Basic Research, Honorary membership awarded to Jes Olesen by the newly established Armenian Society for Pain and Headache

Molecular Migraine & Pain Triggers, LF Talent Prize, IHS Early-Career Headache Science Award and DHOS Talent Prize awarded to Haidar M. Al-Khazali



Honouring Departing Staf

Professor Lars Edvinsson – Acknowledging a Distinguished Scientific Career

The research group led by Professor Lars Edvinsson was established in 1996 in Glostrup and has since focused on the discovery and characterization of perivascular nerves regulating autonomic functions in the control of cerebral blood flow under physiological and pathological conditions.

One of the most significant structural milestones occurred in 2007 with the establishment of Forskerparken. Former industrial buildings, including workshops and a laundry facility, were converted into fully equipped research laboratories, including animal housing. This transformation was made possible through funds allocated to Københavns Amt following the sale of NESA shares. The initiative was led by then Deputy Director of Glostrup Hospital, Morten Brinkløv, and aimed to provide hospital-affiliated clinical researchers with direct access to high-quality laboratory environments in close proximity to the hospital.

Since its founding, Forskerparken was led by Professor Edvinsson. Over recent years, a generational transition was prepared, and in 2023, leadership formally transferred to the current administration following Professor Edvinsson's competent and long-standing leadership. In 2024, he retired from his position. The continued development of Forskerparken will build upon the strong foundation established under his direction, with the aim of preserving its role as a hub for internationally recognized research bridging basic and applied science.

Professor Edvinsson's research has had global impact. Over the past two decades, his group has made fundamental contributions to the understanding of

receptor regulation in cerebrovascular disease. The identification of upregulation of contractile receptors as a disease-modifying mechanism in brain circulation has been central to this effort, with direct clinical translation. A Phase IB/IIA trial based on this work is currently ongoing at the Neurosurgery Clinic at Rigshospitalet and is projected to conclude in Q1 2025. Positive results may contribute to the development of new therapeutic approaches in cerebrovascular disease.

A second major research direction has centred on sensory neurotransmission within the trigeminovascular system. The group discovered calcitonin gene-related peptide (CGRP) in the trigeminal system in 1984, a finding that formed the basis for the current global use of monoclonal antibodies and gepants in migraine treatment. These therapies are now widely implemented in clinical practice.

In recognition of his contributions, Professor Edvinsson received the Lundbeck Brain Prize in 2021, awarded by His Majesty King Frederik of Denmark. His most recent work has focused on the hormonal regulation of the sensory nervous system.



TRACE acknowledges the foundational and internationally recognized contributions of Professor Edvinsson and expresses gratitude for his leadership, scientific achievements, and lasting impact on the institution.





Recognizing More Than 25 Years of Dedication:
Hanne Aggergaard

Hanne Aggergaard Nielsen retired this year after more than 25 years of dedicated service. She has been part of the organization since its earliest days in Ringvejsblokken, through the transition to Forskerparken, and into the present structure now known as TRACE.

Throughout this time, Hanne has provided steadfast support to both administrative and research activities. Her efforts have ensured continuity, efficiency, and a welcoming environment that has shaped the centre's identity and supported its development.

With her departure, a significant chapter in TRACE's history concludes. The foundation that has been built with Hanne's support now enables the centre to move forward with strength and purpose.

Sincere thanks are extended to Hanne for her many contributions. TRACE continues into the future with appreciation for all that has been established.

Acknowledging
Bjarke Skovgaard Hansen

Bjarke Skovgaard Hansen concluded their duties at TRACE in December 2024, respectively. Both provided weekend and holiday coverage in the animal facility, ensuring that basic care routines were maintained and that animals received appropriate daily husbandry during these periods.

His assistance supported the continuity of operations and helped uphold the standard of animal care outside of regular working hours. TRACE extends appreciation for his reliability and contribution to routine tasks during their time at the facility.



Bjarke Skovgaard Hansen

New Grants

BRAWA / Brain Water
- Research grant from Migræne fonden af 1988 -Connar Stanley James Westgate
- Research grant from Migræne fonden af 1988 -Christina Kamp-Jensen
- Novo Nordisk Tandem Grant Rigmor Højland Jensen Professor Maiken Nedergaard

Endocrine Disruption
- DFF Research grant 1, - David Møbjerg Boslev Kristensen
- Lundbeck Ascending Investigator - David Møbjerg Boslev Kristensen

Migraine Basic Research
- Neuroscience Academy Denmark (NAD), Caroline Degel
- BRIDGE Postdoctoral Fellowship –Sarah Louise Christensen
- Equipment grant from Frimodt-Heineke Fonden , Rikke Holm Rasmussen
- Research Grant from Becket Fonden - Song Guo
- Foreningen til støtte af forskning ved Dansk Hovedpine Center - Song Guo

Molecular Migraine & Pain Triggers
- Rigshospitalet Research Foundation – Håkan Ashina
- Lundbeck Foundation – Haidar Al-Khazali

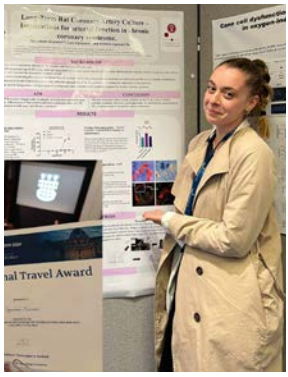
Neuro Genomics
- Independent Research Council: The Cyclome (DFF Project 2), Thomas Folkmann Hansen
- Independent Research Council: The Cyclome (DFF Project 1), Isa Olofsson
- BRIDGE Postdoctoral Fellowship - Isa Olofsson

Sensory Biology
- Research Grant from Migrænefonden af 1988. Kristian A. Haanes
- Research Grant from Migrænefonden af 1988 Philip V. Reducha
- Grant of Excellence – Danmarks Grundforskningsfond – Co-applicant Kristian Agmund Haanes

Representation at conferences

Attending national and international conferences is an integral part of our work at TRACE, enabling us to share our research findings, stay updated on emerging scientific trends, and strengthen collaborations across disciplines. Conferences provide valuable opportunities for early-career researchers to gain visibility, receive feedback, and build professional networks, while also allowing senior scientists to foster strategic partnerships and explore future directions in translational research.

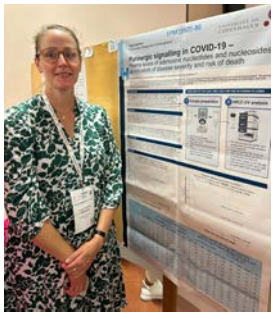
In 2024, members of the TRACE community participated in a wide range of scientific meetings, symposia, and workshops. These events spanned diverse fields including RNA therapeutics, neurobiology, immunology, and bioengineering –reflecting the interdisciplinary nature of our work. Below, we highlight the key conferences attended by TRACE researchers through-out the year.



International Symposium on Mechanism of Vasodilation and EDH 2024, Oxford, United Kingdom



18th European Headache Congress, Rotterdam, The Netherlands





2nd European Purine Meeting 2024, Ferrara, Italy



BII Summer School, Copenhagen, Denmark

Scientific and social events in TRACE

In 2024, TRACE hosted several engaging scientific and social events aimed at fostering collaboration and camaraderie among its scientists, staff, and collaborators. These events combined academic excellence with informal social gatherings, strengthening the community within TRACE.

Glostrup Summer Symposium

The annual Glostrup Summer Symposium took place on May 23, 2024, attracting over 40 scientists, staff, and collaborators. The event featured a full day of scientific discussions, culminating in a social gathering. A highlight of this year's symposium was a scientific contest for early-career researchers. Each participant delivered a brief presentation on their research, which was evaluated based on the scientific content, quality of the oral presentation and the audio-visual material by both the audience and an expert panel.

The competition was intense, reflecting the high quality of all presentations. Ultimately, Rune Häckert Christensen was awarded the 1st prize of DKK 7,500, while Nadja Skadkjær Hansen secured the 2nd prize of DKK 5,000. Both prizes are to be used for attending scientific conferences of their choice.

The symposium also featured keynote presentations. Professor Malene Fischer, Head of the Department of Clinical Physiology, Nuclear Medicine and PET at Rigs-









hospitalet, introduced the innovative Technical University Hospital (TUH) initiative. Additionally, Ilaria Rocca from DTU Health Tech's Center for Diagnostics showcased the centre's High-Throughput Multiplex platforms for biomarker profiling.

Following the stimulating scientific program, attendees participated in a team-building activity at Vridsløselille Prison, which fostered teamwork in a creative setting. The day concluded with a delightful dinner, providing an opportunity for further networking and strengthening interpersonal connections. This inspiring and productive day has set the stage for the Summer Symposium 2025.erested collaborators, clinicians, and other colleagues with an interest in science.







Social club

TRACE's Social Club organized a series of events throughout the year, bringing together members in informal and enjoyable settings.

March – Tango Dance Lesson

The Social Club's activities kicked off in March with a private tango lesson led by Gunnar. Tables were pushed aside, music filled the room, and participants learned basic tango steps in a relaxed and fun atmosphere.



August – DHL Race

In August, two TRACE teams participated in the annual DHL relay race at Fælledparken. With energy and enthusiasm running high, everyone completed the race successfully, celebrating personal achievements with food, drinks, and lively friendship.



October – Halloween Quiz

October brought a spooky twist with a Halloween-themed quiz organized by Emelie and Philip. The meeting room was transformed into a chilling slaughterhouse scene, adding a spooky yet entertaining vibe to the event.

December – Christmas Gathering at Tivoli Hotel

The year concluded with a festive Christmas gathering at the Tivoli Hotel, organized by Sofia and Mette. The evening began with an insightful talk by writer and journalist Lise Kabell Søgaard, who shared the story of her grandmother's sister's experiences with schizophrenia in 1950s Denmark. This was followed by a fun Christmas game and a delicious dinner at the hotel's restaurant, bringing the year to a joyful close.

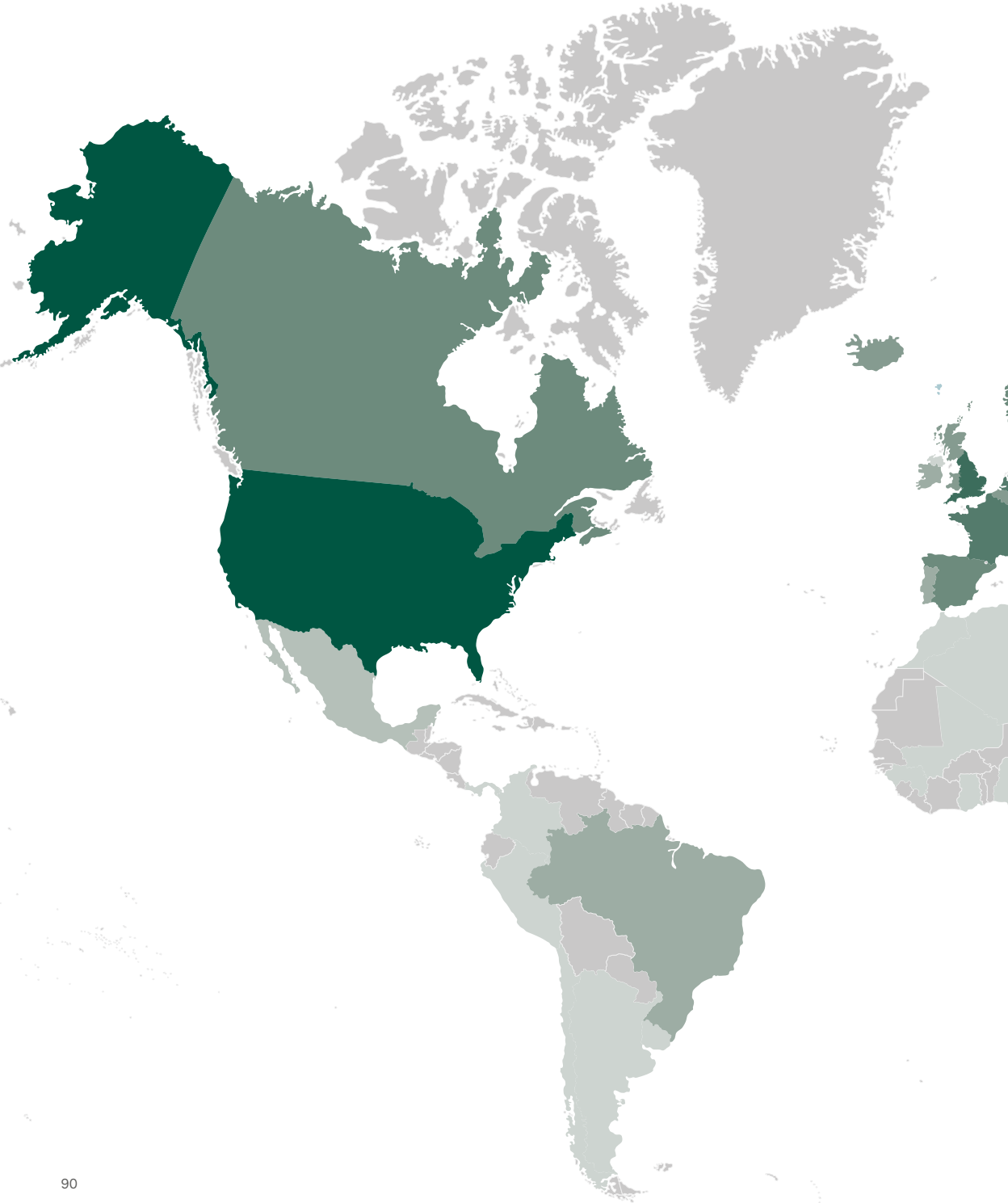








TRACE International collaborations



104
Journal articles

26
Reviews

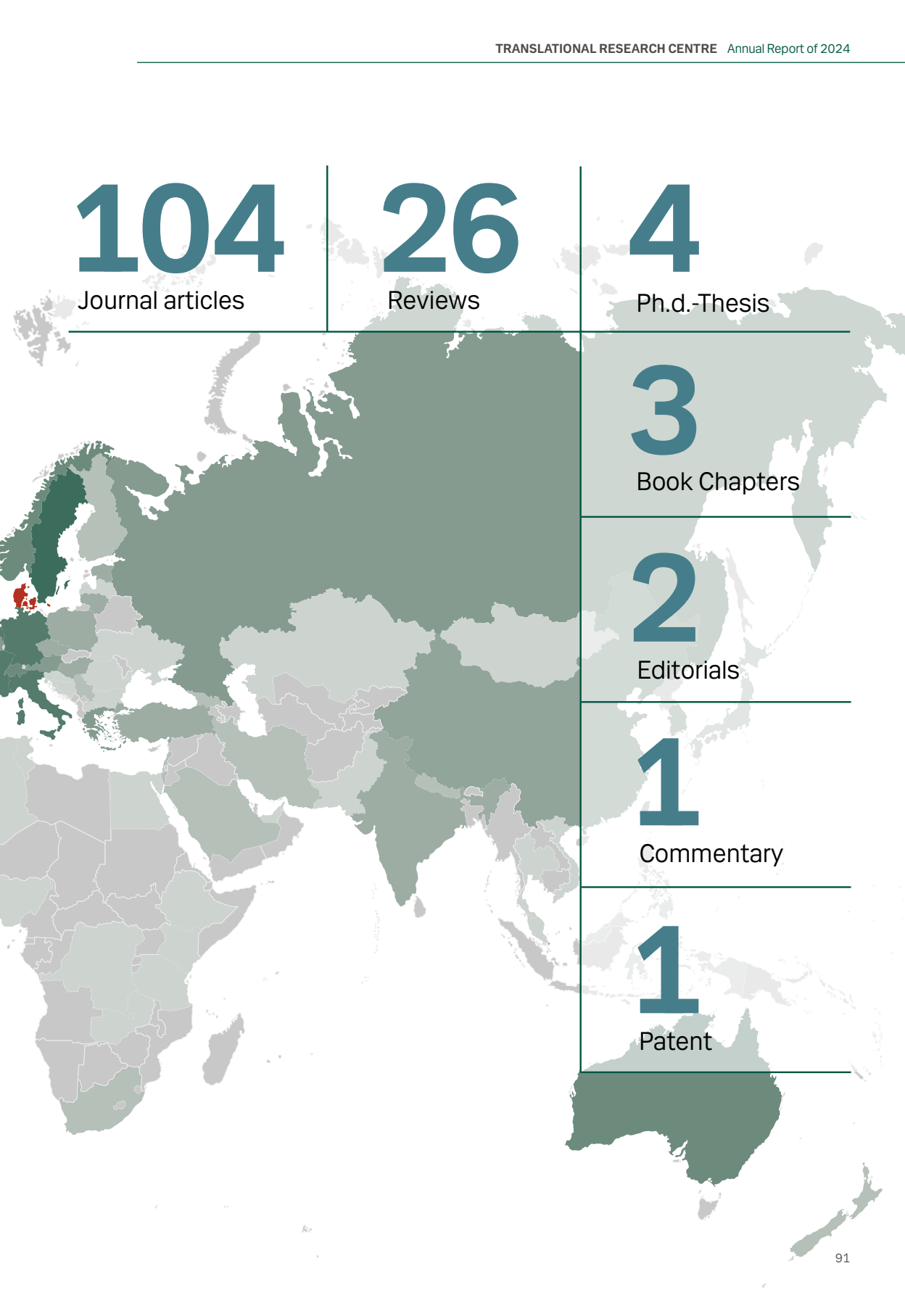
4
Ph.d.-Thesis

3
Book Chapters

2
Editorials

1
Commentary

1
Patent



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