

Turku Collegium for Science, Medicine and Technology (TCSMT)

ANNUAL REPORT 2025

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1. Chair's Foreword



Turku Collegium for Science, Medicine and Technology (TCSMT) has continued to strengthen its role as a centre of research excellence and researcher career development at the University of Turku. Bringing together talented researchers from remarkably broad range of disciplines, the Collegium fosters an environment where new ideas, collaborations and perspectives can emerge across traditional academic boundaries.

During 2025, our researchers produced internationally visible research, secured substantial competitive funding and expanded collaborations with partners around the world. These achievements reflect both the excellence of the researchers and the value of providing dedicated time and support for ambitious research.

At the same time, TCSMT is much more than a funding instrument or a career step. It is a community. Through seminars, workshops, mentoring and informal exchanges, researchers can develop new ideas, learn from one another and build lasting professional networks. The diversity of research represented in TCSMT continues to enrich both individual projects and the wider research culture of the University.

Looking back on the year, I am particularly pleased not only by the achievements reported in these pages but also by the collegial spirit, enthusiasm and mutual support that characterise the TCSMT community. Research excellence grows from talented individuals, but it flourishes in an collaborative environment where people can feel part of something bigger than their own projects.

TCSMT is an investment in the future of the University of Turku: its scientific excellence, international visibility, societal impact and, above all, its people. I thank all our researchers, board members, faculty partners and collaborators for their contributions during the year and look forward to seeing the next achievements of this exceptional community.

Noora Kotaja
Chair of the Board
Turku Collegium for Science, Medicine and Technology

2. TCSMT at a Glance

The University of Turku hosts two research collegia: the **Turku Collegium for Science, Medicine and Technology (TCSMT)** and the Turku Institute of Advanced Studies (TIAS). In 2025, TCSMT was supported by the Faculties of Science, Medicine, and Technology.

TCSMT brings together outstanding early-career researchers across **a broad range of STEM and health disciplines**, including astronomy, biology and biochemistry, biomedicine and biotechnology, chemistry, clinical medicine, computer science, dentistry, future technologies, geology and geography, information technology, materials science and engineering, mathematics, mechanical engineering, nursing science, physics, and statistics.

As part of the University of Turku's wider collegium ecosystem, TCSMT complements TIAS with a distinct focus on science, medicine, and technology. Through competitive open calls, protected research time, interdisciplinary exchange, and structured career support, it **provides a strong platform for developing independent research leaders** and strengthening the university's international research profile.

TCSMT currently co-funds six researchers within the EU-funded MSCA COFUND programme Systemic approaches to improve cardiometabolic and brain health during lifespan (SYS-LIFE), thereby actively contributing to the development of early-career researchers in an international and competitively selected framework. **Hosting MSCA SYS-LIFE Fellows is strategically significant, as it demonstrates TCSMT's ability to engage with major European researcher-development programmes** while reinforcing the broader postdoctoral ecosystem at the University of Turku.

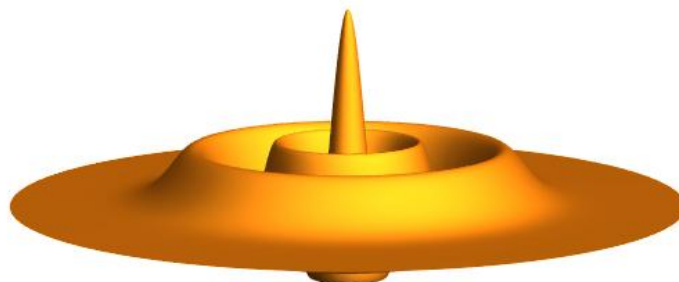


Image: The Wigner function of a four-photon Fock state, visualized by Collegium Researcher Johannes Nokkala.



16–23 researchers annually

€4 million in awarded research grants in 2025

*30 Collegium Researchers completed fellowships
(2008–2024)*

Research Environment and Model

The Collegium provides protected research time, a highly interdisciplinary environment, and structured career support. Fellows develop independent research projects within this multidisciplinary framework, with the Collegium model enabling cross-fertilisation across faculties while maintaining strong disciplinary depth through each Fellow's host environment.

Career Development and Impact

TCSMT has demonstrated strong and sustained outcomes in researcher development. Between 2008 and 2024, 30 Collegium Researchers completed fellowships at TCSMT. By 2023, their career trajectories showed clear upward progression: five advanced to Professorial positions, seven to Assistant Professorships, two to Clinical Teacher roles, thirteen to independent research positions in Finland, and three continued their careers abroad. Overall, 40% of alumni have attained professorial positions, highlighting the effectiveness of the University of Turku's Institute for Advanced Study model in supporting the transition to independent research leadership.

Research Output and Funding

Research output at TCSMT is consistently high. Between 2020 and 2024, the Collegium supported 16–23 researchers annually, who together produced 61–88 peer-reviewed publications per year, corresponding to an average of approximately four peer-reviewed articles per researcher per year. TCSMT researchers are also highly successful in securing competitive external funding. In 2025, they were awarded research grants totalling nearly €4 million from sources including the Research Council of Finland, major Finnish foundations, and international funders.

Application and Evaluation Process

TCSMT maintains a competitive, peer-reviewed open call selection process organised by the Board, with regular calls for Junior Group Leaders and Postdoctoral Researchers. All positions are fixed-term (typically three years), with additional support provided through start-up funding and extension opportunities.

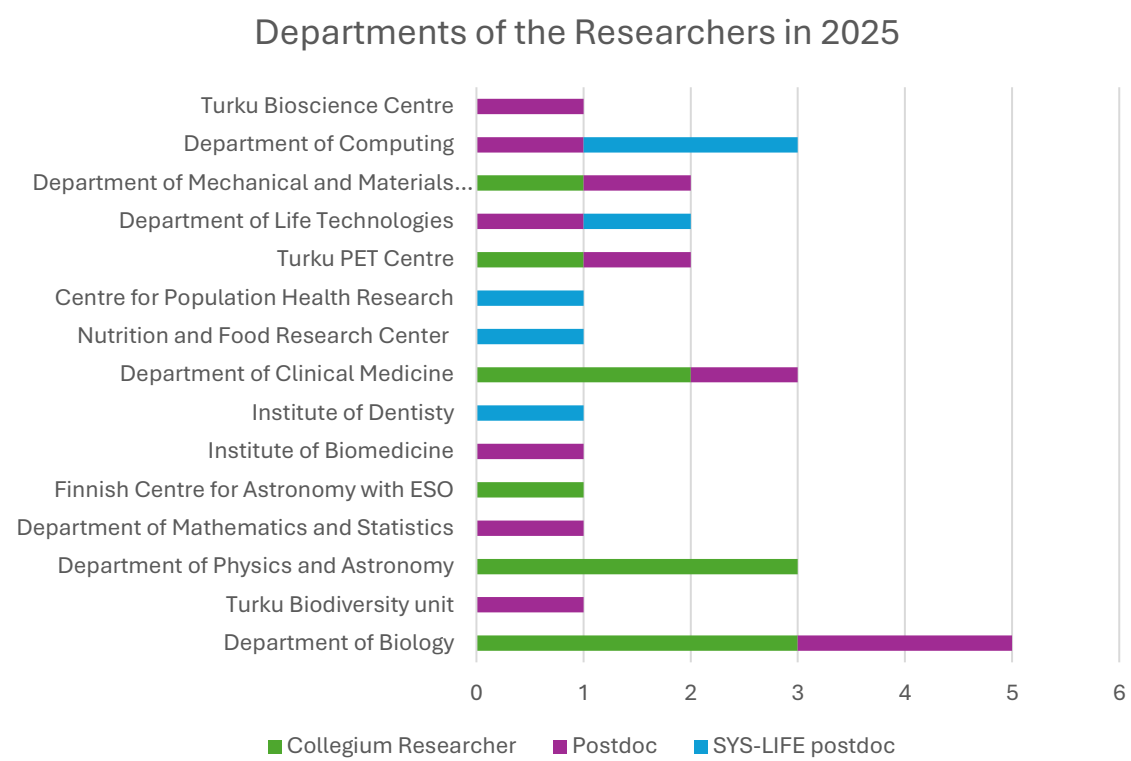
Applicants are evaluated based on their scientific excellence, including international experience, publication record, funding track record, and research networks, as well as the strategic fit of their research with the University of Turku's themes. Final recruitment decisions are made by the TCSMT Board based on overall merit and available resources.

3. Researchers and Research Environment

3.1. Researchers in 2025

Since 2008, the collegium has hosted 35 Postdoctoral Researchers and 45 Collegium Researchers. In 2025, the Collegium comprised 21 researchers. In addition, six researchers from the SYS LIFE postdoctoral programme, partially funded by the Collegium, were appointed to TCSMT; two of them commenced in 2024 and four in 2025. SYS LIFE (Systemic Approaches to Improve Cardiometabolic and Brain Health during the Lifespan) is a Marie Skłodowska Curie researcher programme jointly funded by the University of Turku and the European Union for the period 2023–2028 (project 101126611).

Figure 1 presents the departments where Collegium Researchers and Postdoctoral Researchers are based.



Three out of four researchers at the Collegium were international scholars in 2025.

In 2025, international scholars represented a significant share of the Collegium community, comprising 5 of 11 Collegium Researchers and 6 of 10 Postdoctoral Researchers. Including SYS-LIFE researchers, international scholars numbered 12 out of 16.

TCSMT researchers are encouraged to give feedback to the collegium and ideas on how to develop the activities in TCSMT are welcomed. An annual reporting tool was introduced in 2021 to collect data on the research carried out at TCSMT and on the merits of the collegium's researchers (e.g. success in funding applications, teaching and mentoring activities, and participation in social outreach actions). TCSMT also launched an Exit Survey for collecting feedback on the collegium period from researchers advancing on their scientific careers.



3.2. Research Topics and Profiles

Postdoctoral Researchers

- **Ambrin Babu:** Metabolomics, metagenomics, and diet–microbiota–host interactions in metabolic health
- **Gautier Follain:** Cancer cell biology
- **Gideon Gywa:** Ecological Modeling, Citizen science using emerging technologies, and Biodiversity conservation research in the Anthropocene
- **Anni Hakanen:** Graph theory and distances in graphs
- **Krishna Kant Pandey:** Advanced materials engineering, including additive manufacturing and lunar regolith coatings
- **Carina Nebel:** Ecology and conservation of the Finnish white-tailed eagle, with a focus on renewable energy impacts
- **Liina Salminen:** Immunogenomic biomarkers in non-muscle invasive bladder cancer
- **Jani Sormunen:** Tick-borne pathogens, in vitro tick colonies, and citizen science
- **Mia Ståhle:** Translational approaches to aortic valve stenosis detection and treatment
- **Archana Vishwakarma:** Ultra-sensitive immunoassays and immunocomplex transfer



Collegium Researchers

- **Michael Briga:** Infectious diseases and pertussis dynamics across time
- **Johannes Cairns:** Antimicrobial resistance and microbial community resilience
- **Johanna Hartke:** Galaxy formation and evolution
- **Anni Hämäläinen:** Evolutionary ecology and thermal adaptation in invertebrates
- **Han Li:** From atomic structure to predictable function: single-wall carbon nanotubes for biosensing and nanodevices
- **Kimmo Luoma:** Quantum optics and light–matter interactions in open quantum systems
- **Diana Morosan:** Solar and space physics
- **Johannes Nokkala:** Quantum machine learning and quantum networks
- **Lihua Sun:** Neuroendocrinology and Affective Neuroscience
- **Laura Toivonen:** Nasal microbiome, metabolome, and childhood asthma risk
- **Jetro Tuulari:** Brain development and health



Image: Bacterial strains isolated from wild *Drosophila simulans* flies being transferred to liquid culturing. Photo by Anni Hämäläinen.



SYS-LIFE Researchers appointed to TCSMT

- **Lokendra Birla:** AI Meets Motherhood: Transforming Maternal and Neonatal Health Monitoring with Contactless Physiological Analysis
- **Julian Brandmeier:** Ultrasensitive detection of neurological biomarkers using upconversion nanoparticles paired with digital readout methods
- **Mika Kajita:** The relationship between oral health, diabetes, and cardiovascular disease: a dental anxiety perspective
- **Husna Kaya Kacar:** Nourishing Minds: Maternal Dietary Influences on the NeuroDevelopment of Children (MIND)
- **Yaxing Meng:** Life course blood pressure and cardiovascular prevention
- **Jiawei Yang:** AI for heart monitoring using exercise aware wearables (Exercise4Heart)

4. Research Outputs and Impact

4.1. Publications

Through active national and international collaboration, TCSMT researchers produced at least 75 publications in 2025 (excluding SYS-LIFE publications).

Publication category	JUFO-1	JUFO-2	JUFO-3	(blank)	Grand Total
A1	18	17	25		60
A2	5		1	1	7
A3		1			1
A4	3				3
B1			4		4
Grand Total	26	18	30	1	75

4.2 Networks, Collaboration and Internationality

Researchers expanded international collaboration, initiating new research partnerships with universities across Europe, North America, Asia, Australia, and Israel.

They joined major international consortia, EU projects, and research networks (e.g. Östersjöstiftelsen, NordForsk, COST, eINSPIRE), and participated in EU level citizen science initiatives.

Collaboration was further strengthened with research and public-sector actors in Switzerland, Nigeria, and Greenland, alongside enhanced interdisciplinary cooperation across the life sciences, medicine, physics, and biodiversity research.

Supporting the next generation of researchers: supervision for at least 25 undergraduate students and 30 doctoral candidates.

4.3 Supervision and Teaching

Researchers contributed extensively to teaching and curriculum development across faculties, including guest lectures, course design, and the development of new courses (e.g. interfacial science, zoonoses, participatory mapping methods), as well as teaching in seminars, specialised courses, and international training events.

They also served as academic mentors and evaluators, acting as teacher tutors, supervising undergraduate and doctoral students, assessing theses, and serving on doctoral dissertation committees.

The researchers served as supervisors for at least 25 undergraduate students and 30 doctoral candidates.



Photo: Maiju Kannisto.

5. Funding and External Grants

During 2025, TCSMT researchers were awarded several research grants with a total value of nearly 4 million €.

Researchers in the programme successfully secured funding from a wide range of national and international sources. Major funders included foundations such as the Kone Foundation, Sigrid Jusélius Foundation, and Letterstedtska föreningen, as well as public funding bodies including the Research Council of Finland. International funding was obtained from organisations such as the Knut and Alice Wallenberg Foundation, EDUFI, and the European Southern Observatory (ESO).

In addition, smaller grants and project-specific funding were awarded by university foundations and internal funding instruments (e.g. University of Turku Foundation, FINCA/ESO incentives).

€4M

Research funding secured
in 2025



National foundations: *Kone Foundation, Sigrid Jusélius Foundation, Letterstedtska föreningen*

FI Public funding: *Research Council of Finland, EDUFI*



International funding: *Knut and Alice Wallenberg Foundation, ESO*

Additional project funding from university foundations and internal funding instruments.

6. Key Activities and Events in 2025

In 2025, TCSMT prepared and submitted a major international funding application to the EU Horizon programme (HORIZON-MSCA-2025-COFUND), titled TRANSMIT (Translational Advances in Science, Medicine and Technology) under the “Choose Europe for Science” call.

TCSMT organised its annual full-day summer seminar in Naantali, bringing together recently appointed postdoctoral and Collegium researchers to present their projects. The programme featured a keynote lecture by Anna Haverinen (Explorations of intelligence – where is AI development leading us?) and a panel discussion on AI in Research: Experiences, Ethics, and Opportunities.

In December, a Christmas Seminar was held in Tuorla, where postdoctoral researchers presented short research pitches and more senior Collegium researchers shared reflections on their work and their experiences within TCSMT. The event also included a guided tour of the observatory for researchers and members of the Board.

TCSMT also contributed to the University of Turku Research Collegia Lecture Series, with public lectures delivered by Gautier Follain and Mia Ståhle at the Turku City Library.



Researchers making liquid nitrogen ice cream at Tuorla.
Photo: Maiju Kannisto.

7. Collegium Community and Everyday Activities

The Collegium fosters an active research community through regular monthly lunch meetings and joint seminar and networking events with researchers and the Board, held in summer and December.

The monthly lunch meetings combine informal networking with thematic training sessions featuring invited speakers. Topics have included doctoral supervision training (DocSA), university well-being services, the University of Turku's interdisciplinary themes and strategic focus areas, as well as funding opportunities such as the Research Council of Finland calls. Johanna Hartke introduced the ESO Centre, and Kimmo Luoma presented the interdisciplinary theme New Technologies and Digitalisation.

A training session on Multilevel Science Policy and Research Impact was organised in collaboration with the SYS-LIFE programme in September. Well-being was a key theme throughout the year, addressed through a time management workshop, introduction to university well-being services, and guided active breaks.



Summer seminar participants enjoying champagne yoga. Photo: Maiju Kannisto.

8. TCSMT Management

The Collegium continued to strengthen its administrative practices. The new Board clarified internal working guidelines, while the Collegium Coordinator contributed to university-level initiatives supporting postdoctoral researchers, including career development and mentoring programmes.

A new Board of TCSMT began its term on 1 January 2025. The Rector appointed the following members for the term 1 January 2025–31 December 2029:

- **Piia Seppänen**, Vice Rector
- **Petteri Alho**, Professor
- **Antti Airola**, Associate Professor
- **Georgy Belogurov**, Associate Professor
- **Ulvi Gursoy**, Professor
- **Jussi Kantola**, Professor
- **Noora Kotaja**, Professor, **Chair**
- **Edwin Kukk**, Professor
- **Mirkka Lahdenperä**, Associate Professor
- **Teemu Niiranen**, Professor
- **Maiju Kannisto**, PhD, Coordinator (Secretary)

Collegium researchers were represented on the Board by Collegium Researcher **Kimmo Luoma** and Postdoctoral Researcher **Gautier Follain**.

The TCSMT Coordinator position was held by Maiju Kannisto from the Research Career Unit.

Financial controlling was provided by Anton Sairanen and Markus Piippo.

9. Publications by TCSMT Researchers in 2025

A1 Journal article – refereed

Ambrin Babu:

- [Advanced Microbiome Therapeutics Accelerate MASLD Recovery by Restoring Intestinal Microbiota Equilibrium and the Gut-Liver Axis in a Mouse Model](#)
- [Deep phenotyping of patients with MASLD upon high-intensity interval training](#)

Michael Briga:

- [Socioeconomic Differences in Vaccination Coverage After a Mandatory Vaccination Law, 1855-1900](#)
- [The spatial distribution of pertussis, but not measles or smallpox, in pre-industrial Finland matches dialects](#)
- [Tusks, testosterone and personality in male Asian elephants \(*Elephas maximus*\)](#)

Johannes Cairns:

- [Pre-exposure of abundant species to disturbance improves resilience in microbial metacommunities](#)

Gideon Gywa:

- [The promise of community-driven preprints in ecology and evolution](#)

Anni Hakanen:

- [Distance-based \(and path-based\) covering problems for graphs of given cyclomatic number](#)

Johanna Hartke:

- [E-INSPIRE- I. Bridging the gap with the local Universe: stellar population of a statistical sample of ultra-compact massive galaxies at \$z < 0.3\$](#)
- [INSPIRE: INvestigating Stellar Population In RElics VIII. Emission lines and UV colours in ultracompact massive galaxies](#)
- [INSPIRE: INvestigating Stellar Populations In RElics – IX. KiDS J0842 + 0059: the first fully confirmed relic beyond the local Universe](#)
- [Looking into the faintEst With MUSE \(LEWIS\): Exploring the nature of ultra-diffuse galaxies in the Hydra I cluster III. Untangling UDG 32 from the stripped filaments of NGC 3314A with multi-wavelength data](#)
- [Looking into the faintEst With MUSE \(LEWIS\): Exploring the nature of ultra-diffuse galaxies in the Hydra-I cluster. II. Stellar kinematics and dynamical masses](#)
- [Planetary nebulae as tracers of stellar population properties: a pilot study with MUSE](#)
- [The MUSE view of the Sculptor galaxy: Survey overview and the luminosity function of planetary nebulae](#)
- [Ultra-diffuse, ultra-different: observed versus simulated ultra-diffuse galaxies live in fundamentally different haloes](#)

9. Publications by TCSMT Researchers in 2025

A1 Journal article – refereed

Han Li:

- [High-Speed Hyperspectral Imaging for Near Infrared Fluorescence and Environmental Monitoring](#)
- [High work function large-area carbon black films as conductive, passivated, and hole-selective heterocontact layer for highly efficient solar cells](#)
- [Precise Partitioning of Metallic Single-Wall Carbon Nanotubes and Enantiomers through Aqueous Two-Phase Extraction](#)
- [Single-chirality single-wall carbon nanotubes for electrochemical biosensing](#)

Kimmo Luoma:

- [Dynamics of open quantum systems with initial system-environment correlations via stochastic unravelings](#)
- [Enhancing the Efficiency of Polariton OLEDs in and Beyond the Single-Excitation Subspace](#)
- [Phonon-induced effects in quantum dot absorption and resonance fluorescence with a hierarchy of pure states](#)

Yaxing Meng:

- [Blood pressure in childhood, young- and mid-adulthood: association with carotid plaque severity](#)
- [Natural transitions of non-high-density lipoprotein cholesterol levels in children 9-11 years of age](#)

Diana Morosan:

- [Determining the acceleration regions of in situ electrons using remote radio and X-ray observations](#)
- [Fine structures of a solar type III radio bursts observed with LOFAR](#)
- [Imaging and spectropolarimetric observations of a band-split type II solar radio burst with LOFAR](#)
- [Resolving spatial and temporal shock structures using LOFAR observations of type II radio bursts](#)
- [Source location and evolution of a multilane type II radio burst](#)
- [The source sizes of type II radio bursts with LOFAR](#)

Carina Nebel:

- [A LEAP Forward in Wildlife Conservation: A Standardized Framework to Determine Mortality Causes in Large GPS-Tagged Birds](#)
- [Habitat imprinting in breeding territory selection of a long-lived bird of prey](#)
- [Supplementary winter feeding is associated with higher recruitment rates in a population of a scavenging bird of prey](#)
- [Weather Extremes in the Mediterranean Winter Are Associated With Reduced Apparent Survival and Delayed Initiation of Egg-Laying in a Migratory Raptor](#)

9. Publications by TCSMT Researchers in 2025

A1 Journal article – refereed

Johannes Nokkala:

- [Smarter usage of measurement statistics can greatly improve continuous variable quantum reservoir computing](#)
- [Transfer and routing of Gaussian states through quantum complex networks with and without community structure](#)

Jani Sormunen:

- [Ghosts of weather past? Impact of past and present weather-related factors on the seasonal questing activity of Ixodes ricinus nymphs in southwestern Finland](#)
- [Living with ticks: Results of an online survey of the knowledge, attitudes and practices \(KAP\) regarding ticks and tick-borne pathogens in academic environments across Europe](#)
- [There Goes the Neighbourhood—A Multi-City Study Reveals Ticks and Tick-Borne Pathogens Commonly Occupy Urban Green Spaces](#)
- [Ticks and Tick-Borne Pathogens Encountered by Dogs and Cats: A North European Perspective](#)

Lihua Sun:

- [Anorexia nervosa is associated with higher brain mu-opioid receptor availability](#)
- [Dark seasons enhance brain and brown adipose tissue interactions related to mu-opioid receptor signaling](#)
- [Impact of Day Length on Brain Glucose Metabolism in Men: A Large-Scale Repeated Measures PET Study](#)
- [Obesity is associated with increased brain glucose uptake and activity but not neuroinflammation \(TSPO availability\) in monozygotic twin pairs discordant for BMI—Exercise training reverses increased brain activity](#)
- [Reward responses to vicarious feeding depend on body mass index](#)

Jetto Tuulari:

- [Associations between maternal pre-pregnancy BMI and mean diffusivity of the hippocampus and amygdala in infants](#)
- [Associations of Leukocyte Telomere Length With Trait Resilience, Adverse Childhood Experiences, and Psychological Distress Among Expecting Parents in the FinnBrain Birth Cohort](#)
- [Exposure to childhood maltreatment is associated with specific epigenetic patterns in sperm](#)
- [Gestational diabetes mellitus and children's social-emotional development, behavioral problems, and psychological adjustment](#)
- [Gestational Duration and Postnatal Age-Related Changes in Aperiodic and Periodic Parameters in Neonatal and Toddler Electroencephalogram \(EEG\)](#)
- [Measuring adverse childhood experiences by interviewing children at 9 and 10 years of age: Prevalence, concordance with mother-reports, posttraumatic stress disorder symptoms, and subjective experience of being asked about adverse childhood experiences in FinnBrain Birth cohort study](#)

9. Publications by TCSMT Researchers in 2025

A1 Journal article – refereed

- [Paternal adverse childhood experiences and offspring’s attentional disengagement from faces at 8 months—Results from the FinnBrain Birth Cohort Study](#)
- [Pre- and postnatal maternal depressive symptoms associated with local connectivity of the left amygdala in 5-year-olds](#)
- [Prenatal exposure to perfluoroalkyl substances predicts multimodal brain structural and functional outcomes in children aged 5 years: a birth cohort study](#)
- [Prenatal Substance Exposure and Obesity: Trajectories of Tri-Ponderal Mass Index in Early Adolescence](#)
- [Sex-specific associations between maternal prenatal inflammation and offspring cortical morphology in youth: A harmonised study across four birth cohorts](#)
- [The FinnBrain multimodal neonatal template and atlas collection](#)

Jiawei Yang:

- [MMM: A Unified Weakly-supervised Anomaly Detection Framework for Multi-distributional Data](#)
- [MSS-PAE: Saving Autoencoder-based Outlier Detection from Unexpected Reconstruction](#)

A2 Review article in a scientific journal

Ambrin Babu:

- [Analysis of Methylated Quaternary Ammonium Compounds Using Hydrophilic Interaction Liquid Chromatography Combined With Mass Spectrometry](#)
- [Anthocyanins as protectors of gut microbiota: mitigating the adverse effects of microplastic-induced disruption](#)
- [Metabolic Signatures in Lean MASLD: Current Insights and Future Directions](#)

Johanna Hartke:

- [Planetary nebulae as tracers of accreted stellar populations in massive galaxies in groups and clusters](#)

Jani Sormunen:

- [Tick-Borne Viruses in Finland: Public Health Risks, Interventions and Research Insights](#)

Mia Ståhle:

- [New Promising Targets for Imaging in Cardiovascular Diseases](#)

Jetro Tuulari:

- [Consortium profile: the methylation, imaging and NeuroDevelopment \(MIND\) consortium](#)

9. Publications by TCSMT Researchers in 2025

A3 Book section, chapters in research books

Lihua Sun:

- [The Endogenous Opioid Neurotransmission and Seasonal Affective Disorders](#)

A4 Article in conference proceedings

Anni Hakanen:

- [On a Tight Bound for the Maximum Number of Vertices that Belong to Every Metric Basis](#)

Johanna Hartke:

- [Planetary nebulae populations in the haloes of nearby massive early-type galaxies](#)
- [Survey of Planetary Nebulae in the Andromeda galaxy \(M 31\)](#)

B1 Journal article

Johannes Cairns:

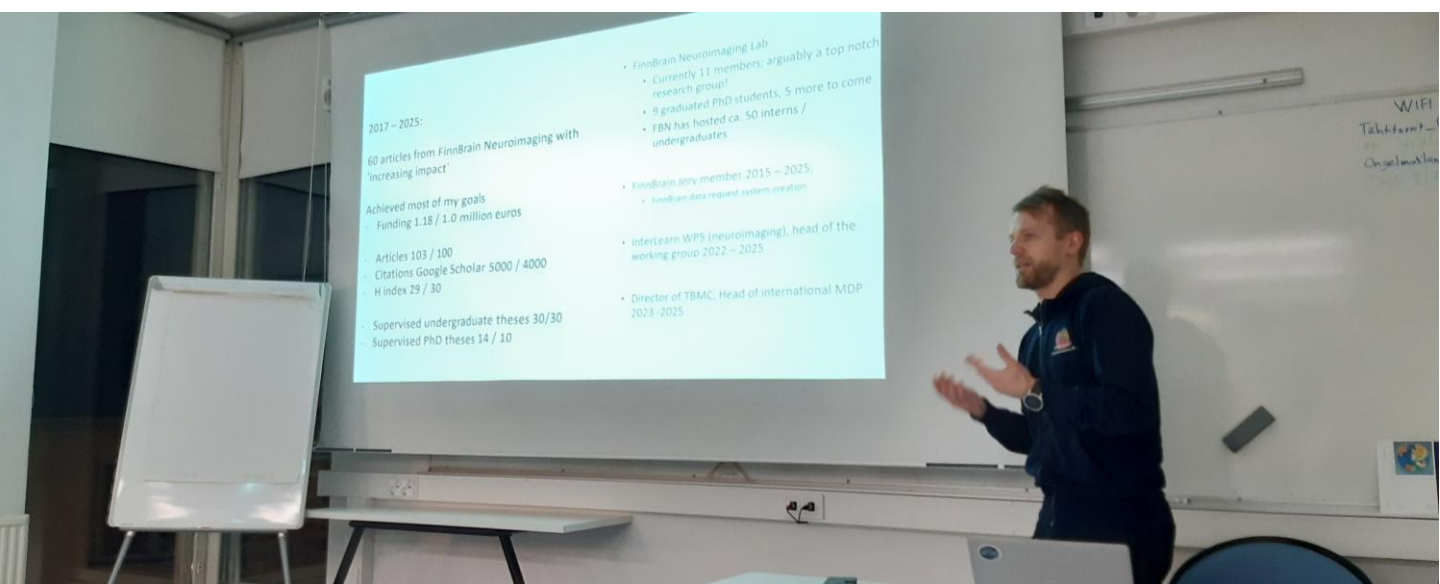
- [Jørn Borup: Decolonising the Study of Religion](#)
- [Pre-exposure to disturbance enhances species resilience and protects from change](#)

10. Further information

For further information, please visit [Turku Collegium for Science, Medicine and Technology website](#).

Follow us on Bluesky [@tcsmtutu.bsky.social](#)

For more information, you may also contact TCSMT Coordinator Maiju Kannisto at tcsmt-info@utu.fi



Collegium Researcher Jetro Tuulari reflecting on his time at TCSMT during the Christmas Seminar. Photo: Maiju Kannisto.

Get inspired.



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