InFLAMES
Solution is in Immunity

Research portfolio 2026 - 2028

InFLAMES Research Flagship

Innovation Ecosystem Based on the Immune System

The InFLAMES Research Portfolio 2026–2028 presents an extensive overview of the InFLAMES Research Flagship, a joint initiative of the University of Turku and Åbo Akademi University in Finland. As part of the Research Council of Finland's Flagship Programme, InFLAMES unites academic excellence with innovation, aiming to transform cutting-edge immunological research into practical health, societal, and economic solutions.

Research Council of Finland

UNIVERSITY OF TURKU

Åbo Akademi University

Summary

The InFLAMES Research Portfolio 2023–2024 presents an extensive overview of the InFLAMES Research Flagship, a joint initiative of the University of Turku and Åbo Akademi University in Finland. As part of the Research Council of Finland's Flagship Programme, InFLAMES unites academic excellence with innovation, aiming to transform cutting-edge immunological research into practical health, societal, and economic solutions.

Purpose and Vision

InFLAMES focuses on understanding normal and abnormal immune responses that underlie diseases such as cancer, autoimmune disorders, infections, metabolic diseases, and neurodegenerative conditions.
Its vision is to create an innovation ecosystem based on the immune system, bridging fundamental science, clinical applications, and industrial collaboration.

Scope and Structure

The Flagship encompasses:

- Over 50 multidisciplinary research groups
- More than 100 industrial collaborators
- Over 1,100 scientific publications

These groups contribute to diverse fields, including molecular immunology, cancer immunotherapy, infection biology, neuroimmunology, metabolic diseases, and health economics.

Research Themes

This document organizes the research portfolio into thematic areas:

1. **Inflammation and Immunology** – covering molecular systems immunology, leukocyte trafficking, autoimmune diseases, macrophage biology, and lymphocyte activation.
2. **Cancer and Immunotherapy** – focusing on cell adhesion, tumor microenvironment, cancer signaling, immuno-oncology, and translational pathology.
3. **Diabetes, Obesity, and Atherosclerosis** – addressing metabolic inflammation and cardiovascular disease mechanisms.

4. **Neuroimmunology** – exploring immune processes in the brain and neuroinflammation.
5. **Infection Immunology** – examining microbiome research, antimicrobial resistance, and infectious disease immunity.
6. **Immunological Diagnostics and Technology Platforms** – including antibody engineering, imaging, radiopharmaceuticals, and computational biomedicine.
7. **Health Economics and Society** – integrating innovation management, market access, and health economics research.

Education and Training

InFLAMES also serves as a hub for education and professional development. The InFLAMES Doctoral Module offers specialized courses in immunology, diagnostics, drug development, and scientific communication. Regular seminars and workshops bring together academia, industry, and healthcare professionals to exchange knowledge and foster collaboration.

Collaboration and Impact

The portfolio highlights InFLAMES' strong commitment to translational research and public–private partnerships. Collaborations with biotech and pharmaceutical companies drive the development of diagnostics, therapeutics, and preventive strategies. Many research groups have patented discoveries, illustrating the program's capacity for innovation and commercialization.

Leadership and Outlook

Directed by Academician Sirpa Jalkanen, InFLAMES positions Finland as a global leader in immunological research and innovation. Its integrated approach—linking fundamental biology, clinical science, and industry—seeks to accelerate the discovery and implementation of solutions that improve human health and strengthen the bioeconomy.

Table of contents

Introduction

We are an ambitious and dedicated top-level immunological R&D cluster. The InFLAMES Flagship transforms leading immunological research into economic and societal impact, in close collaboration with biotech and pharmaceutical partners. As part of the Research Council of Finland's Flagship Programme, InFLAMES drives innovation that benefits both science and society.

A joint initiative of the University of Turku and Åbo Akademi University, InFLAMES builds a comprehensive ecosystem that connects cutting-edge immunological research, education, and industry collaboration. Our mission is to turn discoveries in immunology into real-world health solutions by deepening the understanding of the immune system in both health and disease.

With over 50 multidisciplinary research groups, 100+ industrial collaborators, and more than 1,100 publications, InFLAMES leads breakthroughs in areas such as autoimmunity, infection, cancer, and metabolic disease—advancing immunology-based diagnostics, therapies, and drug development.

Beyond research, InFLAMES is a hub for education and innovation. Through the InFLAMES Doctoral Module, specialized training, and industry-linked programs, we nurture the next generation of experts in immunology, biotechnology, and translational medicine.

As Director Academician Sirpa Jalkanen notes:

> *"Our researchers are looking for solutions to diseases that affect almost every individual. We have a profound impact on people's lives and on society as a whole."*

Standing at the forefront of Finnish and global immunological research, InFLAMES continues to drive discovery, enable innovation, and empower society through science.

Website: inflames.utu.fi

Contact: Academician, Director of the Flagship Sirpa Jalkanen, Director | sirjal@utu.fi | +358 40 566 9611

Education and training

InFLAMES Flagship organizes education and training targeted to immunologists and others interested in the field. Education is organized through the InFLAMES Doctoral Module but is available to interested external parties as well. Most of the courses can be freely attended by registering in advance.

The InFLAMES Doctoral Module is an educational unit for the Doctoral Researchers of InFLAMES-affiliated research groups, providing education on immunology, immunology-based drug development and/or diagnostics. The courses have been tailored to be suitable for Doctoral Researchers and students of comparable education level.

You can find a list of courses organized by InFLAMES below (updated 6/2025). For an up-to-date list visit the Education page on InFLAMES Website. For more information or to register to any of the InFLAMES courses, please contact InFLAMES Research Coordinator Sampo Koivunen | sampo.koivunen@utu.fi.

Research Method Studies

- InFLAMES Flow Cytometry Online Course
- InFLAMES Flow Cytometry Practical Training
- Immunohistology in Research
- Imaging Immunology

General Education

- InFLAMES Professional Development
- Business, Innovation & Market Access – Pharma Market and Value of Medicines
- Presentation and Communication Skills – Essential Tools and Tips
- Education on Scientific Publishing

Journal Club

- Journal club hosted by InFLAMES visiting professors and others

Study Courses

- Basic Immunology
- Advanced Immunology
- Annual Study Events
- Annual start-of-the-year seminar
- Annual InFLAMES Doctoral Module summer event

Seminar series

- Monthly InFLAMES Flagship Seminars
- Inside Industry InFLAMES Seminars
- Immunology Seminar Series
- Prospects of Infections and Immunity
- Frontiers of Science seminars
- Seminar Series of Infections and Immunity

Research Portfolio

Principal Investigators

Molecular systems immunology

Professor Riitta Lahesmaa, MD, PhD

Director of Turku Bioscience Centre, University of Turku and Åbo Akademi University | Professor, Institute of Biomedicine | University of Turku | Member of InFLAMES Executive Team

Key words:

T-cell activation and differentiation,

type 1 diabetes,

autoimmunity,

epigenetics,

immune regulation

Area of expertise

- Regulation of immune response
- Pathogenesis of type 1 diabetes and other immune-mediated diseases
- Molecular basis and modulation of human T-cell differentiation and functions
- Biomarker discovery through omics approaches

Research projects

- Molecular mechanisms of human T-cell differentiation and function
- Modulation of T-cell responses in autoimmunity and cancer
- Early markers to detect type 1 diabetes and its rate of progression to improve prediction, monitoring, and early diagnosis of the start of the disease process

Special methodologies & techniques

- Various methods are used to address our research questions in primary human immune cells including:
- Gene depletion using siRNA and CRISPR/Cas9 approaches
- Single cell transcriptomics & mass cytometry
- Mass spectrometry-based discovery and targeted proteomics
- Genome-wide and targeted analysis of epigenetic modifications
- Integration of different levels of data and information
- We exploit these methods and approaches along with longitudinal samples from patient cohorts for biomarker discovery andvalidation

Collaborations

Open to new collaborations

- Novel regulators of regulatory and effector T-cells
- Biomarker discovery through omics

Ongoing collaborations

- National and international collaborations with scientists in both academia and industry including:
- EU-funded public–private partnerships: INNODIA & INNODIA Harvest against type 1 diabetes (30 academic and 7 industrial partnerts)
- EU-funded consortia: HEDIMED and INITIALISE
- Our collaboration with ORION Pharma focuses on onco-immunology

Selected publications

A systematic comparison of FOSL1, FOSL2 and BATF-mediated transcriptional regulation during early human Th17 differentiation. Nucleic Acids Research. 2022; 50:4938–4958. DOI: 10.1093/nar/gkac256

Type 1 diabetes in children with genetic risk may be predicted very early with a blood miRNA. Diabetes Care. 2022; 45:e77-e79. DOI: 10.2337/dc21-2120

Genome-wide CRISPR screens in T helper cells reveal pervasive crosstalk between activation and differentiation. Cell. 2019; 176:882-896. DOI: 10.1016/j.cell.2018.11.044

Transcriptional repressor HIC1 contributes to suppressive function of human induced regulatory T cells. Cell Rep. 2018; 22:2094-2106. DOI: 10.1016/j.celrep.2018.01.070

Patents

Moulder R, Bhosale S, Goodlett D, Lähdesmäki H, Simell O, Lahesmaa R. Means and methods for determining risk of type-1 diabetes by serum protein biomarkers. Patent family PCT/FI2015/050448

Chakroborty D, Reddy EM, Elo L, Lahesmaa R, Ristimäki A, Haglund C. L1TD1 as predictive biomarker of colon cancer. Patent family PCT/FI2019/050416

Pending patents

We have a number of patent applications pending

rilahes@utu.fi

+358 40 718 4813

Leukocyte traffic and the immune response

Professor Marko Salmi, MD, PhD

Vice-Director InFLAMES Flagship | Institute of Biomedicine | University of TurkU

Key words:

Lymph nodes, antigen transport, myeloid cells, inflammation

Area of expertise

- Lymph node biology
- Differentiation and traffic of myeloid cells
- Immunological biomarkers

Research projects

- Stromal cells of lymph nodes in inflammation
- Transfer of soluble antigens into lymph nodes
- Regulation of endothelial permeability
- The effects of cell origin and tissue niche in differentiation of myeloid leukocytes
- Immunological biomarkers in inflammation and cancer

Special methodologies & techniques

- Microscopy (e.g. high-resolution imaging, whole-mount imaging, mass cytometric imaging)
- Cytometry (multicolour FACS, mass cytometry)
- Single-cell RNAseq
- *In vivo* models (e.g. cell fate-mapping, cell-type–specific knock-outs, antigen transport)

Collaborations

Open to new collaborations

- Targeted immunomodulation in lymph node
- Controlling vascular permeability

Training to offer

- Methods for analysing lymph node stroma (collaboration)

Selected publications

Generation, localization and functions of macrophages during the development of testis. Nat Commun. 2020; 11:4375. DOI: 10.1038/s41467-020-18206-0

Transcytosis route mediates rapid delivery of intact antibodies to draining lymph nodes. J Clin Invest. 2019; 129:3086-3102. DOI: 10.1172/JCI125740

Fetal liver endothelium regulates the seeding of tissue-resident macrophages. Nature. 2016; 538:392-396. DOI: 10.1038/nature19814

The endothelial protein PLVAP in lymphatics controls the entry of lymphocytes and antigens into lymph nodes. Nat Immunol. 2015; 16:386-396. DOI: 10.1038/ni.3101

Patents

Irjala H, Jalkanen S, Salmi M. Common lymphatic endothelial and vascular endothelial receptor-1 (CLEVER-1) and uses thereof. U.S. Patent #7,910,097 (granted 2011)

https://sites.utu.fi/salmilab/

Leukocyte traffic and the immune response

marko.salmi@utu.fi

+358 40 718 4813

Systemic autoimmunity and immune deficiencies

Adjunct Professor Arno Hänninen, MD, PhD

Clinical Teacher | Institute of Biomedicine | University of Turku; Chief Doctor | Laboratory Division | Turku University Hospital

Key words:

Autoantibodies,

autoimmune diseases,

cellular immunology,

gut microbiota and immune system,

systemic lupus,

T-cell deficiencies

Areas of expertise

- Immune mechanisms in systemic autoimmunity
- T-lymphocyte activation and T-cell responses and recirculation in autoimmunity
- Gut microbiota and gut immune system as players in autoimmunity
- Laboratory diagnostics of systemic autoimmune diseases and immune deficiencies

Research projects

- Immune phenotypes and innate immune responses in systemic lupus erythematosus (SLE)
- Gut dysbiosis and immune mechanisms of islet inflammation in autoimmune diabetes
- Metabolic competence of gut microbiota and its role in the development of microbiota diversity
- T-lymphocyte growth and homeostasis in immune deficiencies

Special methodologies & techniques

- T-cell responses to recall antigens and growth factors/ mitogens
- Phenotyping of human T-cells and B-cells in immune deficiencies and in autoimmunity
- Profiling of innate and adaptive immune activity and responses in blood mononuclear cells using single-cell transcriptomics and functional *in vitro* tests
- Gut microbial metaproteomics in evaluation of microbiota metabolic competence

Collaborations

Open to new collaborations

- Laboratory tests in autoimmune diseases and immune cells for clinical trials
- Implementation of clinical trials in the ongoing prospective study in patients with SLE

Ongoing collaborations

- Scientific collaboration with researchers from Harvard, Frankfurt and Melbourne
- Scientific collaboration with clinicians (hospital) and researchers (InFLAMES groups)

Training to offer

- Research training for doctoral candidates and postdoctoral research fellows

Selected publications

Infection with the enteric pathogen C. rodentium promotes islet-specific autoimmunity by activating a lymphatic route from the gut to pancreatic lymph node. Mucosal Immunol. 2022; 15:471-479. DOI: 10.1038/s41385-022-00490-2

Gut dysbiosis promotes islet-autoimmunity by increasing T-cell attraction in islets via CXCL10 chemokine. J Autoimmun. 2023; 140:103090. DOI: 10.1016/j.jaut.2023.103090

Characterization of Expanded Gamma Delta T Cells from Atypical X-SCID Patient Reveals Preserved Function and IL2RG-Mediated Signaling. J Clin Immunol. 2023; 43: 358–370. DOI: 10.1007/s10875-022-01375-6

Long-Lasting T Cell Responses in BNT162b2 COVID-19 mRNA Vaccinees and COVID-19 Convalescent Patients. Front Immunol. 2022; 13. DOI: 10.3389/fimmu.2022.869990

Patents

Harrison L, Hänninen A, Martinez N, Kramer D. A method of prophylaxis and treatment. European Patent Office #EP1225912A1 (date of filing 20.10. 2000).

Systemic autoimmunity and immune deficiencies arno.hanninen@utu.fi +358 29 450 4545

Myeloid cells during pathology

Associate Professor Alexander Mildner, PhD

Department of Biomedicine | University of Turku

Key words:

Cebpb,
epigenetics,
macrophages,
monocytes,
neuroinflammation

Areas of expertise

- Role of tissue-resident macrophages and monocytes during health and disease
- Epigenetic basis of myeloid differentiation
- Pathogenic processes during neuroinflammation and Alzheimer's disease
- Function of the transcription factor Cebpb
- Tissue imprinting of myeloid cells
- Dendritic cell biology

Research projects

- We study the role of adipose tissue macrophages during obesity. Our aim is to modulate their inflammatory response to reduce metabolic inflammation.
- During atherosclerosis, foamy lipid-laden macrophages accumulate in arteries. We aim to manipulate the lipid degradation of foamy macrophages and allow the efficient catabolism of ingested lipids. By this, we will prevent plaque growth and reduce inflammation.
- We further study the role of Cebpb in monocyte differentiation during autoimmune neuroinflammation.

Special methodologies & techniques

- Animal disease models (e.g. atherosclerosis, obesity, EAE, Alzheimer)
- Transcriptomics (scRNA-Seq and bulk RNA-Seq)
- Epigenetics (ATAC-Seq and Cut&Run)
- Transgenic mouse lines
- Imaging mass spectrometry
- Flow cytometry (FACS, CyTOF)

Collaborations

Open to new collaborations

- Bayer (for FDA-approved drugs to manipulate macrophage function)
- Dr Pia Rantakari, University of Turku, FI

Ongoing collaborations

- Dr Simon Yona, Hebrew University of Jerusalem, IL
- Prof. Dr Steffen Jung, Weizmann Institute of Science, IL

Training to offer

- Monocyte and macrophage biology
- Basics of epigenetics (e.g. RNA-Seq, ATAC-Seq, ChIP-Seq)
- Cell isolation and analysis by flow cytometry and cell sorting
- Advantages and disadvantages of animal disease models

Selected publications

C/EBPβ regulates lipid metabolism and Pparg isoform 2 expression in alveolar macrophages. Sci Immunol. 2022; 9:16;7(75):eabj0140. DOI: 10.1126/sciimmunol.abj0140

Tongue immune compartment analysis reveals spatial macrophage heterogeneity. Elife. 2022; 6:24;11:e77490. DOI: 10.7554/eLife.77490

Cxcl10+ monocytes define a pathogenic subset in the central nervous system during autoimmune neuroinflammation. Nat Immunol. 2020; 5:21(5):525-534. DOI: 10.1038/s41590-020-0661-1

Patents

Mack M, Prinz M, Brück W, Mildner A. Treatment of multiple sclerosis and/or rheumatoid arthritis with anti-ccr2 antibodies. EU Patent #EP2004692B1 (granted 2007)

https://mildnerlab.utu.fi/

Myeloid cells during pathology

almild@utu.fi

Macrophage ontogeny and function

Adjunct Professor Pia Rantakari, PhD

InFLAMES Group Leader | Institute of Biomedicine | University of Turku; Head of Cytometry Core | Turku Bioscience Centre | University of Turku and Åbo Akademi University

Key words:

Immune–endocrine interaction,

in vivo,

macrophages,

myeloid cells

Areas of expertise

- Focus on the development of prenatal myeloid cells
- Embryonic macrophage biology
- Reproductive endocrinology
- Focus on immune–endocrine cross-talk
- Expert in advance cytometry

Research projects

- Physiological impact of development, ontogeny and spatial niche of early myeloid cells in endocrine systems
- Molecular mechanism and physiological function of foetal monocyte migration
- Biology of early endothelial permeability
- Early myeloid cells in the development of adipose tissues

Special methodologies & techniques

- Cytometry (multicolour and spectral FACS, mass cytometry)
- *In vivo* models (e.g. cell fate mapping, gain and loss of function, cell type-specific deletion, prenatal and foetal models)
- Microscopy (e.g. whole-mount imaging, imaging mass cytometry)
- Single-cell and spatial multi-omics

Collaborations

- Open to new academic and industry collaboration in projects related to communication and relationship of immune and endocrine system

Training to offer

- Advice in planning cytometry experiments
- Advice in processing tissue samples

Selected publications

Single-cell proteomics reveals the defined heterogeneity of resident macrophages in white adipose tissue. Front Immunol. 2021; 12:719979. DOI: 10.3389/fimmu.2021.719979

Embryonic macrophages function during early life to determine invariant natural killer T cell levels at barrier surfaces. Nat Immunol. 2021; 699-710. DOI: 10.1038/s41590-021-00934-0

Generation, localization and functions of macrophages during the development of testis. Nat Commun. 2020; 11:4375. DOI: 10.1038/s41467-020-18206-0

Fetal–derived macrophages persist and sequentially maturate in ovaries after birth. Eur J Immunol. 2020; 50(10):1500-1514. DOI: 10.1002/eji.202048531

https://plvap.utu.fi/

Macrophage ontogeny and function

pia.rantakari@utu.fi

+358 40 042 6791

Single-cell immunogenomics

Adjunct Professor Tapio Lönnberg, PhD

InFLAMES Group Leader | Core Facility Head | Turku Bioscience Centre | University of Turku and Åbo Akademi University

Key words:

Genomics,

immune regulation,

omics,

single cell

Areas of expertise

- Immune regulation
- Single-cell genomics
- Spatial omics
- T cell immunology

Research projects

- Immunoprofiling of lymphocyte responses in inflammatory arthritis and osteoarthritis
- Reprogramming of macrophage phenotypes as an early predictor of cardiovascular and metabolic disease development
- Identification of predictive biomarkers for systemic lupus erythematosus (SLE) with precision immunogenomics

Special methodologies & techniques

- Single-cell transcriptomics and proteogenomics
- Immune receptor repertoire analyses
- Spatial transcriptomics
- Bioinformatics analyses of single-cell omics data

Collaborations

Open to new collaborations

- Application of single-cell immunoprofiling in clinical cohorts
- Drug molecule screening for disease-perpetuating T cells in inflammatory arthritis
- Organ-on-chip models and tissue microarrays for spatial profiling of immune cell regulation in arthritis and cardiovascular disease

Training to offer

- Sample preparation for single-cell sequencing and spatial omics and preparation of sequencing libraries

Selected publications

Human adipose tissue-derived stem cell paracrine networks vary according metabolic risk and after TNFα -induced death: An analysis at the single-cell level. Metabolism 2021; 116: 154466. DOI: 10.1016/j.metabol.2020.154466

Transcriptome dynamics of CD4+ T cells during malaria maps gradual transit from effector to memory. Nat Immunol. 2020; 21: 1597-1610. DOI: 10.1038/s41590-020-0800-8

Single-cell RNA-seq and computational analysis using temporal mixture modeling resolves TH1/TFH fate bifurcation in malaria. Sci Immunol. 2017; 2(9):eaal2192. DOI: 10.1126/sciimmunol.aal2192

https://bioscience.fi/research/single-cell-immunogenomics/

taplon@utu.fi

+358 29 450 3738

Lymphocyte activation

Adjunct Professor Pieta Mattila, PhD

InFLAMES Group Leader | Institute of Biomedicine | University of Turku

Key words:

Advanced microscopy,

antigen processing,

B cell antigen receptor signalling,

B cells,

extracellular vesicles,

immune synapse

Areas of expertise

- Regulation of lymphocyte activation
- Antigen receptor signalling, particularly B cell receptor signalling
- Antigen processing for presentation
- Actin cytoskeleton and cellular membranes
- Extracellular vesicle research
- Advanced microscopy methodologies, including super-resolution microscopy

Research projects

- Novel proteomic approaches to better understand early B cell activation
- Functions of intracellular vesicles in immune response and their therapeutic potential
- Extracellular vesicles in B cell activation
- Characterisation of immune synapses and the signal cross-talk in high spatio-temporal accuracy to understand lymphocyte activation

Special methodologies & techniques

- Advanced microscopy methods
- Proximity proteomics
- Extracellular vesicle isolation and characterisation
- *In vivo* mouse models

Collaborations

Open to new collaborations

- Different aspects of B cell activation
- Antigen processing in B cells to optimise vaccine responses

Training to offer

- Various microscopy modalities
- Antigen receptor signalling and lymphocyte activation
- Extracellular vesicle isolation and characterisation

Selected publications

The actin and tetraspanin networks organize receptor nanoclusters to regulate B cell receptor-mediated signaling. Immunity. 2013; 38:461-74. DOI: 10.1016/j.immuni.2012.11.019

Dynamics of the actin cytoskeleton mediates receptor cross talk: An emerging concept in tuning receptor signaling. J Cell Biol. 2016; 212:267-80. DOI: 10.1083/jcb.201504137

B cells rapidly target antigen and surface-derived MHCII into peripheral degradative compartments. J Cell Sci. 2020; 133(5):jcs235192. DOI: 10.1242/jcs.235192

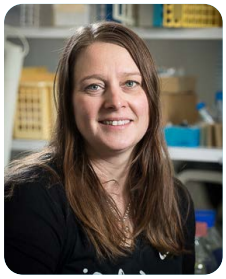
B cell receptor-induced protein dynamics and the emerging role of SUMOylation revealed by proximity proteomics. J Cell Sci. 2023;136(15):jcs261119. DOI: 10.1242/jcs.261119

https://mattilalab.utu.fi/

Lymphocyte activation

pieta.mattila@utu.fi

+358 29 450 4431



Inflammatory signalling

Senior Lecturer Annika Meinander, PhD, Adjunct Professor

Cell Biology | Åbo Akademi University

Key words:

Drosophila,

intestinal inflammation,

molecular genetics,

NF-κB signalling,

non-apoptotic roles of cell death proteins,

ubiquitination

Areas of expertise

- Post-translational modifications, ubiquitination in particular
- NF-κB signalling pathways
- Apoptotic and non-apoptotic roles of caspases
- *Drosophila melanogaster* as a model system

Research projects

- Ubiquitination-mediated regulation of inflammation during cell stress and infection
- Targeting ubiquitin signalling in chronic inflammation and inflammation-induced cancer
- Development of high-affinity aptamers for detection of ubiquitination in inflammation
- Development of anti-inflammatory nano-formulations
- Stilbenoids as lead compounds for inhibition of TRPA1-mediated inflammation
- ÅAU Center of Excellence in Cellular Mechanostasis

Special methodologies & techniques

- Analysis of ubiquitin modifications *in vitro* and *in vivo*
- *Drosophila melanogaster* as a model system to study cell signalling and immune responses

Collaborations

Open to new collaborations

- Detection of ubiquitin modifications for diagnostic purposes

Ongoing collaborations

- European Union COST Action CA20113, ProteoCure - A sound proteome for a sound body: targeting proteolysis for proteome remodeling

Training to offer

- Practical use of *Drosophila melanogaster* as a model organism
- Detection of ubiquitin modifications

Selected publications

M1-ubiquitination facilitates NF-kappaB activation and survival during sterile inflammation, FEBS J. 2022; 289:5180-5197. DOI: 10.1111/febs.16425

Core@shell structured ceria@mesoporous silica nanoantibiotics restrain bacterial growth *in vitro* and *in vivo*. Biomater Adv. 2022; 133:112607. DOI: 10.1016/j.msec.2021.112607

Drice restrains Diap2-mediated inflammatory signalling and intestinal inflammation. Cell Death Differ. 2021; 29:28-39. DOI: 10.1038/s41418-021-00832-w

M1-linked ubiquitination by LUBEL is required for inflammatory responses to oral infection in Drosophila. Cell Death Differ. 2019; 26:860-876. DOI: 10.1038/s41418-018-0164-x

https://www.abo.fi/en/inflammatory-signalling-lab/

Inflammatory signalling lab

annika.meinander@abo.fi

+358 46 920 1699

Cell trafficking in cancer and inflammation

Academician, Professor Sirpa Jalkanen, MD, PhD

Director of InFLAMES Flagship | Institute of Biomedicine | University of Turku

Key words:

Leukocyte trafficking,

cancer,

inflammation,

immunity,

haematopoietic stem cells,

drug development

Areas of Expertise

- Regulation of immune response
- Oncoimmunology
- Focus on mechanisms regulating the traffic of leukocytes and cancer cells
- Specialist in clinical microbiology
- Entrepreneur experience: co-founder of two publicly listed biotech companies

Research projects

- Centred on patent-protected discoveries related to cell trafficking and immune regulation
- Imaging target: VAP-1 – multifunctional adhesin and enzyme
- CD73 – 5'-ectonucleotidase involved in adenosine production & vascular integrity maintenance
- Clever-1 – multifunctional scavenger and adhesion molecule
- Search for new molecules in human lymphatics to mediate cancer spread

Special methodologies & technologies:

- Cell and molecular biology methods
- Animal models
- Imaging tools including unique targets
- Multiplexing (cytokines, chemokines, growth receptors)

Collaborations

Open to new collaborations

- VAP-1 as a target to develop imaging agents to detect inflammation – open to industrial collaboration
- Cancer-induced molecules on lymphatics (potential anti-cancer targets) – open to industrial collaboration

Ongoing collaborations

- Traumakine (iv interferon-beta) up-regulates CD73 (enzyme producing adenosine) by degrading AMP; potential key mechanism in fighting ARDS/COVID-19. Clinical studies ongoing by Faron Pharmaceuticals

Training to offer

- Advice to develop/select therapeutic antibodies
- Advice to choose animal models to mimic human diseases
- Advice to choose the proper approaches/methodologies to address scientific questions containing an immunological component

Selected publications

Vascular adhesion protein-1 defines a unique subpopulation of human hematopoietic stem cells and regulates their proliferation. Cell Mol Life Sci. 2021; 78:7851-7872. DOI: 10.1007/s00018-021-03977-6

Glucocorticoids inhibit type I IFN beta signalling and the upregulation of CD73 in human lung. Intensive Care Med. 2020; 46:1937-1940. DOI: 10.1007/s00134-020-06086-3

Single-cell survey of human lymphatics unveils unexpected heterogeneity and mechanisms of homing for neutrophils. Immunity. 2019; 51:561-572. DOI: 10.1016/j.immuni.2019.06.027

Clever-1 contributes to lymphocyte entry into the spleen via the red pulp. Sci Immunol. 2019; 4(33):eaat0297. DOI: 10.1126/sciimmunol.aat0297

Patents

Several patents including 11 approved U.S. patents such as:

Irjala H, Jalkanen S, Salmi M. Common lymphatic endothelial and vascular endothelial receptor-1 (CLEVER-1) and uses thereof. United States Patent #7,910,097 (granted 2011)

Jalkanen S, Salmi M, Jalkanen M, Maksimow M. Biomarker for monitoring development of diseases and assessing the efficacy of therapies. United States Patent #8,975,081 (granted 2015)

Pending patents

Iftakhar-E-Khuda I, Jalkanen S. Method for promoting expansion of hematopoietic stem cells and agent for use in the method. Patent family PCT/FI2021/050039

https://celltrafficking.utu.fi/

Cell trafficking in cancer and inflammation

sirjal@utu.fi

+358 40 566 9611

Epithelial biology

Assistant Professor Diana Toivola, PhD

Vice-Member of InFLAMES Executive Team | Cell Biology | Bioscience |
Faculty of Science and Engineering | Åbo Akademi University

Key words:

Diabetes,

diagnostics,

inflammatory bowel disease,

keratin,

mouse modelling

Areas of expertise

- Epithelial biology in gastrointestinal organs and related glands
- Cytoskeletal intermediate filaments protein regulation and function, especially simple epithelial keratins and nuclear lamins
- Inflammatory bowel diseases, colorectal cancer and type I diabetes
- Mouse disease modelling
- Non-invasive diagnostics development of intestinal diseases

Research projects

- Non-invasive imaging or biochemistry based diagnostics development for intestinal disorders
- Developing novel mouse models for inflammatory bowel disease and colorectal cancer
- Keratin interactomics and molecular mechanism linking keratins to tumour suppression, proliferation, stress protection, regeneration and mechanosignalling in simple epithelial tissues
- Regulation of glucose-stimulated insulin secretion by beta-cell keratins
- Keratins in regulation of epithelial cell mitochondrial functions
- Investigation of SNPs in keratin pathway genes associated with type 1 diabetes and related disorders
- Center of Excellence in Mechanostasis

Special methodologies & techniques

- Mouse disease modelling, especially models of colitis, colorectal cancer and diabetes
- Intestinal crypt isolation and organoid culture (mini gut)
- Isolation of islets of Langerhans and 3D culture
- Beta-cell and colon cancer cell lines

Collaborations

Open to new collaborations

- Patient material and clinical collaborations on type I diabetes and intestinal disorders
- Gene regulatory study and gene editing expertise
- Company and clinical lab collaborations around diagnostic technologies
- Immune cell–epithelial cell communication

Ongoing collaborations

- Kaija-Leena Kolho, University of Helsinki, FI
- Yatrik Shah, University of Michigan, US
- Bishr Omary, Rutgers University, US
- Karen Ridge, Northwestern University, US
- Anders Molven, University of Bergen, NO
- Anne Roivainen, Turku PET Centre, University of Turku, FI
- Jukka Koffert, University of Turku, FI
- Markku Voutilainen, University of Turku, FI
- Laura Elo, Turku Bioscience, University of Turku/Åbo Akademi University, FI

Training to offer

- Mouse disease modelling of colitis, colorectal cancer and type 1 diabetes
- Isolation and culture of mouse colon epithelial organoids
- Isolation of mouse islets and beta-cells
- Expertise on liver and exocrine pancreas

Selected publications

Colonocyte keratin 7 expression is expressed de novo in inflammatory bowel diseases and associated with pathological changes and drug-resistance.Scientific Reports 2022; 12:22213. DOI: 10.1038/s41598-022-26603-2

Targeted deletion of keratin 8 in intestinal epithelial cells disrupts tissue integrity and predisposes to tumorigenesis in the colon. Cell. Mol. Life. Sci. 2022; 79 (1): 10. DOI: 10.1007/s00018-021-04081-5

Patents/disclosures pending

Toivola D.M., Polari, L. and Helenius, T.O. Method for detecting and subtyping inflammatory intestinal diseases. Finland Patent #FI20225151 (applied 2023)

Pylvänäinen, J., Mairinoja, L, Tuomisto, T., Toivola D.M., Kankanpää, P., Solis, J. Ocul-AR: "Mobile application for Microscopy Teaching and Support". (applied 2023)

http://toivola-lab.org/

Epithelial biology lab

diana.toivola@abo.fi |

+358 50 400 7732

Medical immuno-oncology research (MIORG)

Assistant Professor, Rogerio Figueiredo, PhD

Head of the Medical Immuno-Oncology Research Group | Faculty of Medicine | University of Turku | Turku Biosciencet Centre

Key words:

Antigen presentation,

cold tumours,

dendritic cells,

immune checkpoint therapy,

immunotherapy resistance,

MHC

Areas of expertise

- Reverse translational medicine
- Therapeutic antibody and peptide development
- Cold tumours and immune resistance
- Rational prognostication of poorly immunogenic tumours
- Resistance to immune checkpoint blockade

Research projects

- Fighting antigen presentation faults in metastatic cutaneous melanoma
- Robust prognostication of poorly immunogenic metastatic cutaneous melanomas to anti-PD1 immunotherapies
- Metabolism and immune response in metastatic uveal melanoma
- Development of an immunogenic preclinical model for metastatic uveal melanoma immunotherapy research
- Development of functional prognostication tools for immune checkpoint blockade therapies for non-small cell lung cancer and triple-negative breast cancer

Special methodologies & techniques

- NanoString nCounter and Spatial NanoString GeoMX immune profiling
- High-dimensional single-cell mass cytometry (Helios-2)
- Whole exome sequencing and epigenetic integrative analysis
- Integrative bioinformatic analysis of repository multi-omics data
- T-cell killing assay for drug screening in immunotherapy

Collaborations

Open to new collaborations:

- Antibody affinity maturation studies
- Retrospective and prospective immune landscape profiling (RNA and protein) of primary and metastatic tumours

Ongoing collaborations:

- *In vitro* and *ex vivo* co-culture drug screening platform for the prediction of effective combinations
- Spatial NanoString GeoMX immune profiling of primary and metastatic melanomas
- Single-cell mass cytometry for phenotype of immune progenitor cells

Training to offer

- Methods to analyse transcriptome of retrospective tumour biopsies (bulk and spatial)
- Methods to interpret single-cell mass cytometry data (Phenograph, Cytobank and Cytosplore)
- Methods for primary and metastatic pre-clinical models

Selected publications

Epigenetic control of CD1D expression as a mechanism of resistance to immune checkpoint therapy in poorly immunogenic melanomas. Front Immunol. 2023; 14:1152228. DOI: 10.3389/fimmu.2023.1152228

Novel prognostication biomarker adipophilin reveals a metabolic shift in uveal melanoma and new therapeutic opportunities. J Pathol. 2023; 2:24. DOI: 10.1002/path.6076

Loss of BAP1 expression is associated with an immunosuppressive microenvironment in uveal melanoma, with implications for immunotherapy development. J Pathol. 2020; 1:20 DOI: 10.1002/path.5384

Blockade of MIF-CD74 signaling on macrophages and dendritic cells restores the antitumor immune response against metastatic melanoma. Front Immunol. 2018; 9:1132. DOI: 10.3389/fimmu.2018.01132

https://www.miorg.fi/

Medical immuno-oncology research (MIORG)

crdefi@utu.fi

+358 40 646 2080

Interaction of cells with extracellular matrix

Professor Jyrki Heino, MD, PhD

Professor of Biochemistry | Director of the Department of Life Technologies | University of Turku

Key words:

Cancer,
cell adhesion,
extracellular matrix,
integrins,
matrisome,
proteomics

Areas of expertise

- Extracellular matrix
- Matrisome
- Cell adhesion
- Cancer biology
- Cell invasion
- Cell signalling

Research projects

- ELMI: The leukemic matrisome interface as a source of markers and targets
- Matrisome in human cutaneous squamous cell carcinoma
- The role of embigin, a novel fibronectin receptor, in mouse development
- Structure and function of collagen receptor integrins

Special methodologies & techniques

- Mass spectrometry-based proteomics
- Matrisome-related bioinformatics
- 3D cell culture methods
- Cell adhesion and invasion assays
- Recombinant proteins
- Protein–protein interaction assays
- Cell signalling assays

Collaborations

Open to new collaborations

- Mass spectrometry-related strategies to unveil biomarkers
- Matrisome proteins as biomarkers
- 3D cell cultures in cancer drug development, including immunotherapies

Training to offer

- Mass spectrometry-based proteomics
- Matrisome analysis
- 3D cell cultures

Selected publications

Inflammation-related citrullination of matrisome proteins in human cancer. Front Oncol. 2022; 12: 1035188. DOI: 10.3389/fonc.2022.1035188

Embigin is a fibronectin receptor that affects sebaceous gland differentiation and metabolism. Developmental Cell. 2022; 57: 1453-1465. DOI: 10.1016/j.devcel.2022.05.011

MISpheroID: a knowledgebase and transparency tool for Minimal Information in Spheroid Identity. Nature Methods. 2021; 18: 1294-1303. DOI: 10.1038/s41592-021-01291-4

H-Ras activation and fibroblast-induced TGF-β signaling promote laminin-332 accumulation and invasion in cutaneous squamous cell carcinoma. Matrix Biology. 2020; 87: 26-47. DOI: 10.1016/j.matbio.2019.09.001

utu.fi/en/university/faculty-of-technology/life-technologies/research/biochemistry/structure-and-function-of-collagen-receptor-integrins

Interaction of cells with extracellular matrix group

jyrki.heino@utu.fi

+358 50 523 8351

Translational pathology

Professor Pekka Taimen, MD, PhD

InFLAMES Group Leader | Professor of Molecular Pathology | Institute of Biomedicine | University of Turku; Department of Pathology | Turku University Hospital

Key words:

Bladder cancer, cardiomyopathy, digital pathology, lamin, molecular pathology, prostate cancer

Areas of expertise

- Nuclear structure and chromatin organisation
- Genitourinary pathology (prostate and bladder cancer)
- Cardiovascular and thoracic pathology
- Molecular pathology

Research projects

- Nuclear lamins in human health and disease
- Pathogenesis of LMNA-related cardiomyopathies
- Patient-derived cell culture models for dug sensitivity screening of bladder cancer
- Biomarkers of prostate and bladder cancer
- Prognostic genomic and histopathological features of lung adenocarcinoma
- Artificial intelligence (AI)-assisted digital pathology

Special methodologies & techniques

- Cell and molecular biology methods
- High-resolution microscopy and digital pathology
- Patient-derived cell culture models
- Transgenic mouse model for LMNA-related cardiomyopathy
- Tissue microarrays for prostate and bladder cancer
- Immunohistochemistry and tumour profiling

Collaborations

Open to new collaborations

- Histopathological, immunohistochemical and molecular profiling of urological cancers for preclinical and clinical studies
- Validation of preclinical findings on clinical prostate and bladder cancer material (e.g. tissue microarrays)
- Studies on nuclear mechanics and mechanotransduction
- Pharmaceutical targeting of *LMNA*-related cardiomyopathy using transgenic mouse models
- AI tools for preclinical and clinical histopathology

Ongoing collaborations

- Drug sensitivity screening for bladder cancer using conditionally reprogrammed patient-derived cells (Misvik Biology, FI)

Training to offer

- Advice for histopathological, immunohistochemical and molecular profiling of solid tumours (collaboration)

Selected publications

A pan-cancer analysis shows immunoevasive characteristics in NRF2 hyperactive squamous malignancies. Redox Biol. 2023; 61:102644. DOI: 10.1016/j.redox.2023.102644

Lamin A/C phosphorylation at serine 22 is a conserved heat shock response to regulate nuclear adaptation during stress. J Cell Sci. 2023; 136:jcs259788. DOI: 10.1242/jcs.259788

Actin-microtubule cytoskeletal interplay mediated by MRTF-A/SRF signaling promotes dilated cardiomyopathy caused by LMNA mutations. Nat Commun. 2022; 13:7886. DOI: 10.1038/s41467-022-35639-x

Personalized Drug Sensitivity Screening for Bladder Cancer Using Conditionally Reprogrammed Patient-derived Cells. Eur Urol. 2019; 76:430-434. DOI: 10.1016/j.eururo.2019.06.016

Comprehensive genomic profiling of Finnish lung adenocarcinoma cohort reveals high clinical actionability and SMARCA4 altered tumors with variable histology and poor prognosis. Neoplasia 2022; 32:100832. DOI: 10.1016/j.neo.2022.100832

https://www.taimenlab.fi/

Translational pathology lab

pekka.taimen@utu.fi

+358 50 431 1353

Immune and structural cell interaction in health and disease

Academy Research Fellow Akira Takeda, PhD

Group Leader | Institute of Biomedicine | University of Turku

Key words:

Dendritic cells,

human immunity,

lymphatics,

single-cell, tumour immunity

Areas of expertise

- Human lymphatic system
- Single-cell analysis of immune and structural cells
- Tumour immunity

Research projects

- Human dendritic cell heterogeneity and their unique functions
- Blood and lymphatic endothelial cell heterogeneity in the tumour microenvironment
- Identification of lymphatics in the human spleen through single-cell methodologies
- Special methodologies & techniques
- Human and mouse single-cell/spatial transcriptomics
- CRISPR-based genetic manipulation of primary human immune cells
- Multiphoton intravital microscopy for mouse organs (e.g. lymph node, skin)

Collaborations

Open to new collaborations

- Targeting specific human dendritic cells for cancer immunotherapy
- Manipulation of reprogrammed lymphatics in human tumours

Training to offer

- Training in the analysis or interpretation of single-cell transcriptomics data using various cutting-edge techniques
- Training in multiphoton intravital microscopy for visualising immune cell migration *in vivo*

Selected publications

Lymph node lymphatic endothelial cells as multifaceted gatekeepers in the immune system. Trends Immunol. 2023; 44(1):72-86. DOI: 10.1016/j.it.2022.10.010

Cancer immunotherapies transition endothelial cells into HEVs that generate TCF1+ T lymphocyte niches through a feed-forward loop. Cancer Cell. 2022; 40 (12):1600-1618. DOI: 10.1016/j.ccell.2022.11.002

Single-cell survey of human lymphatics unveils marked endothelial cell heterogeneity and mechanisms of homing for neutrophils. Immunity. 2019; 51(3):561-572. DOI: 10.1016/j.immuni.2019.06.027

Fibroblastic reticular cell-derived lysophosphatidic acid regulates confined intranodal T-cell motility. Elife. 2016; 5:e10561. DOI: 10.7554/eLife.10561

https://takedalab.utu.fi/

Immune & structural cell interaction in health & disease

akitak@utu.fi

+358 29 450 4383

Cell adhesion and cancer

K. Albin Johansson Research Professor Johanna Ivaska, PhD

Professor | Turku Bioscience Centre | University of Turku

Key words:

Cancer biology,

cell motility,

extracellular matrix,

integrins,

mechanotransduction,

tumour microenvironment

Areas of expertise

- Cell adhesion and integrin biology
- Receptor trafficking pathways
- Mechanisms regulating cancer metastasis (cell migration and invasion) *in vitro* and *in vivo*
- Mechanobiology

Research projects

- Microenvironmental containment of tumours through paracrine secretion
- Cancer metastasis — new biological paradigms as drug targets
- Scaffolding Oncogenic Signaling: Identification of clinically relevant signaling integrators
- Biological Barrier Mechanics and Disease: From molecular-scale to tissue-level understanding of signal integration and forces
- Nucleomechanical regulation of cell states from pluripotency to cancer
- Adhesion dynamics and mechanobiological pathways as determinants of oncogenic properties
- Receptor sorting and cytoskeletal regulation in breast cancer

Special methodologies & techniques

- Microscopy
- Mechanobiology
- Micropatterning and rigidity hydrogels
- Endosomal trafficking assays for cell surface receptors
- Proximity biotinylation for defining protein–protein interactomes (BioID)

Collaborations

Ongoing collaborations

- Multiple national and international academic and industry collaborations (examples below):
- Cancer Research UK Beatson Institute: Trafficking pathways driving metastasis *in vivo*; tumour microenvironment profiling
- Research Council of Finland Centre of Excellence (BarrierForce): Barrier mechanics in health and disease

Training to offer

- Introduction to mechanobiological tools including 2D and 3D gradient gels and traction force microscopy
- Introduction to preparing micropatterns
- Introduction to BioID and other screening methods

Selected publications

Directed cell migration toward softer environments. Nat Materials. 2022; 21(9):1081-1090. DOI: 10.1038/s41563-022-01294-2

Cargo-specific recruitment in clathrin- and dynamin-independent endocytosis. Nat Cell Biol. 2021; 23:1073-1084. DOI: 0.1038/s41556-021-00767-x

Integrins as biomechanical sensors of the microenvironment. Nat Rev Mol Cell Biol. 2019; 20:457-473. DOI: 10.1038/s41580-019-0134-2

Patents

Ivaska J, Mattila E. Method for activating T Cell protein tyrosine phosphatase for therapeutic applications. U.S. Patent #7,687,464-B2 (granted 2010)

Heino J, Ivaska J, Käpylä J. Integrin binding peptide and use thereof. U.S. Patent #6,096,707-A (granted 2000)

Pending patents

Five patent applications including:

Lilja, J, Ivaska J, Busch-Petersen J, Compare Cloos PA, Page M. Nanobodies specifically binding to sh3 and multiple ankyrin repeat domains 3 (shank3). WIPO Patent #WO/2023/021181 (applied 2023)

Lilja J, Ivaska J, Pentikäinen O, Niinivehmas Sanna. Therapy of Ras-Dependent Cancers. WIPO Patent #WO/2021/160937 (applied 2021)

ivaskalab.utu.fi/

Cell adhesion and cancer lab

johanna.ivaska@utu.fi

+358 29 450 2260

Cancer cell signaling

Professor Jukka Westermarck, MD, PhD

Research Director | Turku Bioscience Centre; Professor | Institute of Biomedicine | University of Turku

Key words::

Cancer,

CIP2A,

phosphatase,

PP2A,

therapy resistance

Areas of expertise

- Cancer cell signalling
- Phosphatases in cancer
- Cancer therapy resistance
- Drug development and diagnostics

Research projects

- Deregulated phosphatases in human breast cancer
- Phosphatase-targeted drug development and diagnostics
- CIP2A structure–function analysis
- RAS/PP2A-mediated control of critical cancer cell processes

Special methodologies & techniques

- Phosphoproteomics
- Systems biology
- Protein interactions
- Functional screens in cancer cells

Collaborations

Open to new collaborations

- Investigator-initiated clinical trials
- Structural biology

Ongoing collaborations

- RAS-driven phosphorylation mechanisms in cancer
- PP2A reactivator molecule development
- Therapy tolerance in breast cancer
- DNA damage signalling in breast cancer

Training to offer

- Cancer phosphoproteome studies
- Signalling mechanisms

Selected publications

Structural mechanism for inhibition of PP2A-B56a and oncogenicity by CIP2A. Nature Communications. 2023; 14: 1143. DOI: 10.1038/s41467-023-36693-9

CIP2A interacts with TopBP1 and drives basal-like breast cancer tumorigenesis. Cancer Research. 2021; 81: 4319-4331. DOI: 10.1158/0008-5472.CAN-20-3651

CIP2A constrains Th17 differentiation by modulating STAT3 signaling. iScience. 2020:23(3):100907. DOI: 10.1016/j.isci.2020.100947

PP2A inhibition is a druggable MEK inhibitor resistance mechanism in KRAS-mutant lung cancer cells. Science Translational Medicine. 2018:10(450). DOI: 10.1126/scitranslmed.aaq1093

Patents

Seven granted patents including:

Ventelä S, Westermarck J. Eplin as a Biomarker for Cancer. WIPO Patent #WO2021205078A1 (Granted 2022)

Westermarck J, Eriksson J, Kaur A, Peuhu E. Combination Therapy (PME-1). EU Patent #EP2723450B1, U.S Patent #9,476,050, China Patent #ZL200780017037.3, Japan Patent #6001655 (granted 2018)

Mäkelä E, Westermarck J; A Novel CIP2A Variant and Uses Thereof. WIPO Patent #PCT/FI2018/050844, EU Patent #18811327.8, U.S Patent #16/765,084 (granted 2020)

https://bioscience.fi/research/cancer-cell-signaling/

Cancer cell signaling group

jukwes@utu.fi

+358 29 450 2880

Tumor immunology and immunotherapy

Adjunct Professor Maija Hollmén, PhD

InFLAMES Group Leader | MediCity | University of Turku

Keywords

Antibodies, cancer, immunotherapy, macrophages

Areas of expertise

- Preclinical and clinical development of antibodies
- Using human-derived tumour material for immune drug testing
- Mouse tumour models and immunophenotyping
- Multiplex cytokine measurements
- Diagnostic assay development
- Bioinformatics for single-cell and spatial transcriptomics
- Primary cell culture, macrophage and T-cell assays
- Crispr/Cas9 and siRNA in primary cells

Research projects

- Bioengineering soluble Clever-1 for regulating peripheral tolerance
- Breast cancer patient-derived tumour explants for studying the mode-of-action of macrophage-targeted therapies
- Bexmarilimab efficacy in AML — *ex vivo* drug testing and metabolic analyses of myeloblasts
- High-content primary human CRISPR/Cas9 screening to identify novel modulators of macrophage effector functions for drug design and development
- Overcoming chemotherapy-induced leukopenia by targeting the bone marrow niche

Special methodologies & techniques

Nanostring (GeoMx) | Antigen recall assay | Human macrophage polarisation assays | Seahorse | Magnetic isolation of human immune cells | Antibody and protein production (including quality control)

Collaborations

Open to new collaborations

- Drug testing with tumour-derived explant cultures

Ongoing collaborations

- Misvik Biology: Optical proteomic array technology for massively parallel functional immunophenotyping and immuno-oncology diagnostics
- Faron Pharmaceuticals: Preclinical and clinical development of bexmarilimab

Training to offer

- Working with human primary immune cells (isolation, characterisation, flow cytometry)
- Antibody and protein production

Selected publications

Non-clinical characterization of bexmarilimab, a Clever-1-targeting antibody for supporting immune defense against cancers. Mol Can Therapeutics. 2022; 21:1207-1218. DOI: 10.1158/1535-7163.MCT-21-0840

Systemic blockade of Clever-1 elicits lymphocyte activation alongside checkpoint molecule downregulation in patients with solid tumors: Results from a phaTse I/II clinical trial. Clin Can Res. 2021. 27:4205-4220. DOI:10.1158/1078-0432.CCR-20-4862

Immunotherapeutic Blockage of Macrophage Clever-1 Reactivates the CD8+ T Cell Response Against Immunosuppressive Tumors. Clin Can Res. 2019. 1;25(11):3289-3303. DOI:10.1158/1078-0432.CCR-18-3016

Patents

Hollmén M, Viitala M, Jalkanen M and Maksimow M. Diagnosis of immune activation using Clever-1, TNF-alpha and HLA-DR binding agents. Canada Patent #CA3020418 (granted 2020)

Elenius K, Hollmén M and Sliwkowski MX. Isoform specific anti-HER4 antibodies. Canada Patent #CA2744512 (granted 2011)

Pending patents

Hollmén M, Rannikko J and Viitala M. Anti-Clever-1 agents for controlling lysosomal vATPase proton pumps to increase lysosomal pH-value and the cross-presentation of digested matter. FI20195804 (applied 2019)

Hollmén M, Virtakoivu R, Vaura F, Jalkanen J and Mandelin J. Anti-Clever-1 agents for controlling cell surface markers expression on leucocytes, and using these expression levels to guide anti-clever-1 based cancer treatment. FI20195959 (applied 2019)

Hollmén M and Viitala M. Treatment of cancer with Clever-1 inhibition in combination with PD-1/PD-L1 inhibitor. #FI20185563 (applied 2018)

https://hollmenlab.com/

Tumor immunology and immunotherapy lab

maijal@utu.fi

+358 50 514 2893

Key words:

Clinical trial,

HIF,

hypoxia,

oxygen sensing

Clinical cancer research and tumour hypoxia

Professor Panu Jaakkola, MD, PhD

Chief Physician | Department of Oncology | Clinical Cancer Trial Unit | Turku University Hospital; Head | Cancer Research Laboratories | University of Turku

Areas of expertise

- Clinical cancer trials
- Tumour hypoxia
- Renal cell cancers
- Gastrointestinal stromal tumours

Research projects

- Function of cellular oxygen sensors in cancer progression
- Crosstalk of tumour hypoxia and protein modification in cancer
- Clinical cancer trials for solid tumours

Special methodologies & techniques

- Early phase clinical drug trials
- Cell culture and molecular biology work under hypoxia (Hypoxia Workstation)

Collaborations

Open to new collaborations

- Industrial and researcher-initiated cancer drug trials

Ongoing collaborations

- Multiple collaborations on cancer drug trials with pharmaceutical companies
- National and international collaboration on protein modification under hypoxia in cancer

Training to offer

- Education in clinical cancer trials for oncologists and research nurses
- Hypoxic cell culture work

Selected publications

Hypoxia-inducible factor (HIF)-prolyl hydroxylase 3 (PHD3) maintains high_*HIF2A*_mRNA levels in clear cell renal cell carcinoma. J Biol Chem. 2019; 294, 3760 DOI: 10.1074/jbc.RA118.004902

Survival Outcomes Associated With 3 Years vs 1 Year of Adjuvant Imatinib for Patients With High-Risk Gastrointestinal Stromal Tumors: An Analysis of a Randomized Clinical Trial After 10-Year Follow-up. JAMA Oncol. 2020; 6(8):1241-1246. DOI: 10.1001/jamaoncol.2020.2091

A three-feature prediction model for metastasis-free survival after surgery of localized clear cell renal cell carcinoma. Sci Rep. 2021; 11(1):8650 DOI: 10.1038/s41598-021-88177-9

Clinical cancer research and tumour hypoxia group panjaa@utu.fi +358 44 548 3806

Toppari group

Professor Jorma Toppari, MD, PhD

Institute of Biomedicine | University of Turku;
Chief Physician in Pediatrics | Turku University Hospital

Key words:

Cohort study,

developmental biology,

male reproduction,

paediatric endocrinology,

type 1 diabetes

Areas of expertise

- Type 1 diabetes
- Paediatric endocrinology
- Male reproductive health
- Population health research

Research projects

- Principal investigator in Finnish type 1 Diabetes Prediction and Prevention study (DIPP)
- Principal investigator in The Environmental Determinants of Diabetes in the Young study (TEDDY)
- Type 1 Diabetes Intelligence study (T1DI)
- Human Exposomic Determinants of Immune Mediated Diseases (HEDIMED)
- An innovative approach towards understanding and arresting type 1 diabetes (INNODIA)
- TEDDY Family Prevention study (TEFA)
- Maternal and paternal type 1 diabetes — mechanisms for the distinct recurrence risk in the offspring
- Molecular pathways of innate immune system linked to type 1 diabetes
- Incretin-based therapies in three stages of type 1 diabetes
- Early determinants of male reproductive health

Special methodologies & techniques

- Prospective cohort studies
- Live cell technologies
- Transillumination-assisted microdissection techniques+

Collaborations

Open to new collaborations

- Type 1 diabetes studies
- Developmental endocrinology

Ongoing collaborations

- DIPP consortium: University Hospitals of Oulu, Tampere and Turku, FI
- DIPP collaborators: University of Helsinki, FI; University of Eastern Finland, FI; Finnish Institute for Health and Welfare, FI; Turku Bioscience Centre, FI; University of Exeter, UK; University of Florida, US; City of Hope Hospital, US
- TEDDY consortium: Lund University, SE; University of South Florida, US; Institute of Diabetes Research, Helmholtz Zentrum München, GE; University of Colorado, US; Pacific Northwest Diabetes Research Institute, US; Augusta University, US; University of Florida, US
- T1DI consortium: Institute of Diabetes Research, Helmholtz Zentrum München, GE; University of Colorado, US; Pacific Northwest Diabetes Research Institute, US; Lund University, SE; University of Oulu, FI; University of Tampere, FI; IBM Research, New York and Boston, US
- Male reproductive health: University of Copenhagen (DK) and EU-COST Action Andronet

Training to offer

- Clinical and experimental type 1 diabetes research methods
- Clinical and experimental male reproductive health research

Selected publications

Two-age islet-autoantibody screening for childhood type 1 diabetes: a prospective cohort study.

Lancet Diabetes Endocrinol. 2022; 10:589-596. DOI: 10.1016/S2213-8587(22)00141-3

Generation, localization and functions of macrophages during the development of testis. Nat Commun. 2020; 11:4375. DOI: 10.1038/s41467-020-18206-0

Childhood Height Growth Rate Association with the Risk of Islet Autoimmunity and Development of Type 1 Diabetes. J Clin Endocrinol Metab. 2022; 107:1520-1528. DOI: 10.1210/clinem/dgac121

What is the role of puberty in the development of islet autoimmunity and progression to type 1 diabetes? Eur J Epidemiol. 2023; 8:20. DOI: 10.1007/s10654-023-01002-7

https://popc.utu.fi/

Toppari group

jorma.toppari@utu.fi

+358 40 180 2600

Clinical imaging of neuroinflammation

Professor Laura Airas, MD, PhD

Department of Clinical Neurosciences | University of Turku; Neurology Consultant | Tyks Neurocentre | Turku University Hospital | Member of InFLAMES Executive Team

Key words:

Drug development,

innate immune system,

long COVID,

microglia,

MRI,

multiple sclerosis,

neurodegeneration,

neuroimmunology,

neurology,

PET imaging

Areas of expertise

- Neuroimmunology
- Multiple sclerosis (MS) treatment and pathology
- Focus on the biology and pathology of the central nervous system (CNS) in healthy individuals and in neuroinflammatory and neurodegenerative diseases
- Early phase development of therapies for neurodegenerative diseases
- Specialist in clinical neuroimmunology
- Expert in positron emission tomography (PET) and other advanced clinical imaging methods
- Longstanding expertise in performing clinical trials in the field of neurology

Research projects

- Evaluation of smouldering, diffuse innate immune system activation in progressive MS brain using PET imaging
- Development of novel imaging modalities for microglia, astrocytes and synaptic density to be applied for human imaging in various neurodegenerative conditions
- Identification of soluble biomarkers and their association with clinical and imaging parameters in MS
- Detection of iron laden innate immune cells and their co-localisation with PET-measurable innate immune cell activation in assessment of smouldering inflammation in MS brain
- Prediction of MS progression using multiparametric approaches
- Search for new outcome measures for progressive MS trials and treatment response evaluation
- Evaluation of neuroimmunology in patients suffering from Long Covid
- Evaluation of glial pathology in Parkinson's disease

Special methodologies & techniques

- PET imaging and advanced MRI including diffusion tensor imaging (DTI)-MRI and quantitative susceptibility mapping (QSM) of the brain
- Development of artificial intelligence-based methods for image analysis
- Neuropathology
- Soluble biomarker analyses
- Animal models of neuroinflammation

Collaborations

Open to new collaborations

- Basic immunology researchers (establishment of new therapeutic targets for reducing microglial activation, addressing interplay between CNS and peripheral inflammatory cells)
- Biomarker developers (we have a significant collection of MS blood samples, including frozen cells, matched with PET and MRI imaging)
- Pharma companies addressing CNS inflammation and neurodegeneration (phase II proof-of-concept studies with TSPO-PET imaging as an outcome marker)

Ongoing collaborations

- Investigator-initiated studies examining the following:
- Effect of cladribine treatment on microglial activation in the CNS, supported by Merck Serono (GE)
- [11C]PK11195 brain PET study targeting secondary progressive MS – effect of teriflunomide treatment on microglial activation in an MS cohort at risk of progression, supported by Sanofi Genzyme (FR)
- Progressive Multiple Sclerosis Alliance-funded consortium: Leader: Laura Airas; Collaborators Prof. Jens Kuhle, Basel, CH; Prof. David Pitt, Yale University, US; and Dr Scott Allen, Sheffield, UK

Training to offer

- Training in modelling and analysing conventional MRI, TSPO-PET, DTI-MRI and QSM-MRI data
- Training in the clinical evaluation of patients with MS and in designing progressive MS clinical trials

Selected publications

Positron emission tomography in multiple sclerosis: straight to the target. Nat Rev Neurol. 2021; 17:663-675. DOI: 10.1038/s41582-021-00537-1

Association of serum neurofilament light with microglial activation in multiple sclerosis. J Neurol Neurosurg Psychiatry. 2023; 5:2:jnnp-2023-331051. DOI: 10.1136/jnnp-2023-331051

https://turkupetcentre.fi/neuroinflammation-research/

Neuroinflammation imaging lab

laura.airas@utu.fi

+358 50 329 4321

Rinne group

Professor Juha Rinne, MD, PhD

Turku PET Centre | University of Turku | Turku University Hospital

Key words:

Alzheimer, biomarkers, brain imaging, memory disorders, PET

Areas of Expertise

- Neurology: especially neurodegenerative diseases such as Alzheimer´s and Parkinson´s disease
- Neuroimaging: positron emission tomography (PET), magnetic resonance imaging (MRI)
- Drug development
- Clinical drug trials

Research projects

- Clinical, imaging (beta-amyloid, neuroinflammation, MRI), preclinical and stem cell research in individuals with different genetic risks to develop Alzheimer´s disease (ALZTRANS)
- Clinical and imaging studies (beta-amyloid, synaptic density, MRI) in participants in a multi-domain intervention study (FINGER) to slow down cognitive impairment and prevent dementia in elderly individuals with increased risk scores to develop dementia
- Clinical and imaging (beta-amyloid, neuroinflammation, MRI) study in healthy elderly individuals with and without insulin resistance ('prediabetes'; CIRI, PI Laura Ekblad, MD, PhD)
- Clinical, imaging (beta-amyloid, neuroinflammation, synaptic density, MRI) and fluid biomarker study in healthy elderly individual with different gene doses of apolipoprotein E epsilon 4 allele (increasing the risk to develop Alzheimer´s disease; ASIC-E4, PI Anniina Snellman, PhD)

Special methodologies & techniques

- PET and MRI imaging and automated image analysis
- Development of new PET tracers
- PET in drug development
- Fluid biomarkers (blood, cerebrospinal fluid [CSF])

Collaborations

Open to new collaborations.

- Please contact to discuss.

Ongoing collaborations

- University of Eastern Finland (Prof. Mikko Hiltunen, Adj. Prof. Anna-Kaisa Haapasalo), University of Helsinki (Prof. Jari Koistinaho), FI
- Finnish Institute of Health and Welfare (Adj. Prof. Tiia Ngandu, Prof. Miia Kivipelto), University of Eastern Finland (Adj. Prof. Alina Solomon), FI
- University of Gothenburg (Prof. Kaj Blennow, Prof. Henrik Zetterberg), SE
- Combinostics Oy (Adj. Prof. Jyrki Lötjönen, Adj. Prof. Juha Koikkalainen), FI

Training to offer

- Use of PET in drug development

Selected publications

Tau-targeting antisense oligonucleotide MAPTRx in mild Alzheimer's disease: a phase 1b, randomized, placebo-controlled trial. Nat Med. 2023; 4:24. DOI: 10.1038/s41591-023-02326-3

APOE ε4 gene dose effect on imaging and blood biomarkers of neuroinflammation and beta-amyloid in cognitively unimpaired elderly. Alzheimer´s Res Ther. 2023; 4;15(1):71. DOI: 10.1186/s13195-023-01209-6

Association of Midlife Inflammatory Markers With Cognitive Performance at 10-Year Follow-up. Neurology. 2022; 11:15;99(20):e2294-e2302. DOI: 10.1212/WNL.0000000000201116

New insights into the genetic etiology of Alzheimer's disease and related dementias. Nat Genet. 2022; 4:54(4):412-436. DOI: 10.1038/s41588-022-01024-z

juha.rinne@tyks.fi

+358 50 441 2400

Kinase function in brain

Research Director Eleanor Coffey, PhD

Vice Director | Turku Bioscience Centre | University of Turku and Åbo Akademi University

Key words:

Protein kinases, biomarkers, Parkinson's disease, neuroinflammation, adult neurogenesis, phosphoproteomics, neuropsychiatric.

Areas of Expertise

- Protein kinases
- Molecular, cellular and brain circuit-level mechanisms that lead to functional deficits in brain
- Early diagnosis of neurological disorders
- Parkinson's disease and associated neuroinflammation
- Biomarker development
- Neuroinflammatory processes in neurodegenerative and psychiatric disorders
- Proteomics and PTM proteomics
- Data science (proteomic data analysis and scRNAseq)
- Imaging (Fiber photometry *in vivo* brain imaging, STORM)
- Neurobiological methods

Research projects

- Defining proteomic biomarkers for Parkinson's disease from patient blood
- Identifying prognostic biomarkers of patient responsivity to fast-acting antidepressants
- Parkinson's disease mechanism & target validation
- Single cell analysis of JNK1 regulated genes in mouse brain
- Linking brain protein phosphorylation to affective behaviours in mice

Special methodologies & techniques

- Primary neuron and cell line culture
- Viral vector applications
- Advanced microscopy methods
- Mouse brain fibre photometry
- Animal models for Parkinson's disease
- Mass spectrometry
- (Phospho)protein, cell and tissue immunostaining

Collaborations

Open to new collaborations.

- Biomarkers for neurodegenerative and neuropsychiatric diseases
- Fiber photometry (GCaMP/DLIGHT)
- Parkinson's disease mechanism
- Affective disorder mechanism

Ongoing collaborations

- Parkinson's biomarkers: several ongoing collaborations and joint funding applications
- Three ongoing collaborations with Michael J Fox Foundation on biomarker identification and target validation for Parkinson's disease

Selected publications

Regulators of proteostasis are translationally repressed in fibroblasts from patients with sporadic and LRRK2-G2019S Parkinson's disease. NPJ Parkinsons Dis. 2023;9:20. DOI: 10.1038/s41531-023-00460-w

PhosPiR: an automated phosphoproteomic pipeline in R. Brief Bioinform. 2022; 23:bbab510. DOI: https://doi.org/10.1093/bib/bbac153

Protein synthesis is suppressed in sporadic and familial Parkinson's disease by LRRK2. FASEB J. 2020; 34:14217. DOI: 10.1096/fj.202001046R

JNK1 controls adult hippocampal neurogenesis and imposes cell autonomous control of anxiety behaviour from the neurogenic niche. Mol Psychiatry. 2018;23:362. DOI: 10.1038/mp.2016.203

Pending patents

Flinkman D, Deshpande P, Lauren L, Peltonen S, Kaasinen V, James P. Coffey E. Diagnosis of Parkinson's disease on the basis of decreased overall translation. U.S. (Pending)

eleanor.coffey@bioscience.fi

+358 40 182 2424

Atherosclerosis, heart disease and inflammation

Professor Juhani Knuuti, MD, PhD

Vice-Director of InFLAMES Flagship | Director of Turku PET Centre | Department of Clinical Physiology, Nuclear medicine and PET | Turku University Hospital and University of

Key words:

Turkucardiology,

cardiac imaging,

PET imaging,

computed tomography,

atherosclerosis,

coronary artery disease,

heart failure

Areas of Expertise

- Research focus on coronary artery disease (CAD) and heart failure
- Expert in clinical cardiovascular multimodality imaging, especially positron emission tomography (PET) and molecular imaging and computed tomography (CT)
- Specialist in clinical physiology and nuclear medicine
- Longstanding expertise in performing clinical trials in the field of cardiology

Research projects

- Evaluation of factors defining clinical outcome in patients with CAD
- Coronary plaque inflammation in CAD
- Large vessel and valve inflammation in patients with atherosclerosis
- Systemic, total body effects of cardiovascular diseases
- Machine learning in predicting myocardial ischemia and outcome in patients with chest pain
- Special methodologies & techniques
- Advanced multimodality imaging methods especially PET and CT with novel molecular imaging tracers
- Machine learning methods for image and clinical data analyses
- We also offer image analysis core-lab services

Collaborations

Open to new collaborations

- Academic sites and industry especially in projects focusing on novel molecular imaging methods, cardiovascular imaging, total body imaging or machine learning methods for image analysis or predicting clinical outcome

Ongoing collaborations

- Investigator-initiated studies examining the following:
- The short-term effects of sacubitril/valsartan therapy on cardiac oxygen consumption and efficiency of cardiac work in patients with heart failure, supported by Novartis
- The safety, tolerability and pharmacodynamics of ninerafaxstat in subjects with angina due to obstructive coronary artery disease, supported by Imbria Pharmaceuticals, Inc.
- Advanced analysis of coronary CT angiography with artificial intelligence, supported by Cleerly, Inc.

Training to offer

- Advice and training in analysing and interpreting multimodality imaging especially focusing on cardiovascular diseases

Selected publications

CT or invasive coronary angiography in stable chest pain. N Engl J Med. 2022; 386:1591-1602 DOI: 10.1056/NEJMoa2200963

Coronary calcium scoring improves risk prediction in patients with suspected obstructive coronary artery disease. J Am Coll Cardiol. 2022; 80:1965-1977. DOI: 10.1016/j.jacc.2022.08.805

Classification of ischemia from myocardial polar maps in 15O-H2O cardiac perfusion imaging using a convolutional neural network. Sci Rep. 2022; 12:2839 DOI: 10.1038/s41598-022-06604-x

Exploiting glutamine consumption in atherosclerotic lesions by positron emission tomography tracer (2S,4R)-4-18F-fluoroglutamine. Front Immunol. 2022; 13:902544 DOI: 10.3389/fimmu.2022.821423

juhani.knuuti@tyks.fi

+358 500 592 998

Key words:

Atherosclerosis,

cardiovascular,

cohort studies,

epidemiology

Population health research

Professor Olli Raitakari, MD, PhD

Director of the Centre for Population Health Research | University of Turku | Turku University Hospital; Professor in Cardiovascular Medicine | University of Turku

Areas of expertise

- Cardiovascular epidemiology
- Vascular imaging
- Specialist in clinical physiology

Research projects

- Coordinator of the national Cardiovascular Risk in Young Finns Study
- Director of the STRIP Study (atherosclerosis prevention study in children and young adults)
- Co-principal investigator (co-PI) of the International Childhood Cardiovascular Cohort consortium
- PI of the MULTIPEPIGEN study (epidemiological study of epigenetic inheritance in humans)

Special methodologies & techniques

- Organisation of large-scale cohort studies
- Vascular and cardiac imaging
- Population omics

Collaborations

Open to new collaborations

- Datasets of our population studies can be utilised in collaborative projects with data transfer agreements

Ongoing collaborations

- The names of existing collaborations are listed on the study websites (see below).

Selected publications

Childhood Cardiovascular Risk Factors and Adult Cardiovascular Events. Med. 2022; 5:19;386(20):1877-1888. DOI: 10.1056/NEJMoa2109191

Childhood adiposity, adult adiposity, and cardiovascular risk factors. Med. 2011; 11:17;365(20):1876-85. DOI: 10.1056/NEJMoa1010112

Diminishing benefits of urban living for children and adolescents' growth and development. Nature 2023; 3:615(7954):874-883. DOI: 10.1038/s41586-023-05772-8

Height and body-mass index trajectories of school-aged children and adolescents from 1985 to 2019 in 200 countries and territories: a pooled analysis of 2181 population-based studies with 65 million participants. Lancet. 2020; 11:7;396(10261):1511-1524. DOI: 10.1016/S0140-6736(20)31859-6

Cohort study websites:

- The Cardiovascular Risk in Young Finns Study,
- Special Turku Coronary Risk Factor Intervention Project (STRIP Study),
- International Childhood Cardiovascular Cohorts (i3C) Consortium,
- MULTIEPIGEN Study

Population health research group

olli.raitakari@utu.fi

+358 40 768 2897

Microbiome and antimicrobial resistance

Professor Cecilia Söderberg-Nauclér, MD, PhD

Director of Infection and Immunity Unit | Institute of Biomedicine | University of Turku

Key words:

Antiviral therapy,

brain tumours,

cancer cell metabolism,

human cytomegalovirus,

immunometabolism,

inflammation

Areas of expertise

Immunometabolism | Cancer cell metabolism | Role of human cytomegalovirus (HCMV) pathogenesis in inflammation and cancer | Viral host cell receptor studies | HCMV latency and reactivation | Antiviral treatment of brain tumours

Research projects

- Changes in cellular metabolism dictate activation of immune cells such as M1-type macrophages, dendritic cells and T cells and are required for tumour cell growth. This metabolic change is often referred to as the Warburg effect. We intend to understand the initial signals that activate the Warburg effect towards finding new treatment targets for inflammatory diseases and cancer. By utilising HCMV, which is often reactivated in these diseases, as a tool to identify key mechanisms that initiate the Warburg effect, we hope to find new targets for therapy for these diseases.
- We treated patients with glioblastoma with anti-HCMV drugs and observed highly improved survival rates. Our ongoing randomised controlled clinical phase II trial will evaluate the efficacy of valganciclovir in patients with glioblastoma (NCT04116411).

Special methodologies & techniques

- Virology methods and electron microscopy studies
- Studies of cellular metabolism (Seahorse)
- Flow cytometry (multicolour FACS, mass cytometry)
- Confocal microscopy
- Primary tumour and stem cell cultures
- Gene knock outs using siRNA and CRISPR/Cas9 approaches
- Zebrafish

Collaborations

Open to new collaborations

- Immunometabolism
- Cancer cell metabolism
- Mitochondrial biogenesis and energy production
- Viral pathogenesis (HCMV pathogenesis)
- HCMV vaccines and antivirals for treating patients with cancer

Ongoing collaborations

- Ongoing international academic collaborations on HCMV latency and reactivation, viral-induced DNA damage mechanisms, cell signalling, mitochondrial biogenesis and energy production.
- Ongoing international multicentre clinical trial on antiviral treatment of brain tumours.
- Ongoing collaborations with Immunor AS in Norway to develop an HCMV vaccine for patients with cancer and with Sinsa AB in Sweden on small molecules aiming to reverse antibiotic resistance in gram negative bacteria.

Training to offer

- Virological methods | Seahorse | Mitochondrial electron transport chain (ETC) functions | Zebrafish

Selected publications

Human cytomegalovirus hijacks host stress response fueling replication stress and genome instability. 2022; 2:22. DOI: 10.1038/s41418-022-00953-w

Valganciclovir as add-on to standard therapy in glioblastoma patients. Clin Cancer Res. 2020; 8:1;26(15):4031-4039. DOI: 10.1158/1078-0432.CCR-20-0369

Patents

Nine patents with the following highlights:

Naucler, C. Genetic variant of cytomegalovirus (cmv). EU Patent #EP2697248B1 (granted 2017)

Prevention of cell migration initiation with CMV US28 receptor antagonists. U.S Patent #06420121B1 (granted 2002)

Treatment of cytomegalovirus using aminopeptidase N (6511662)

Homman, M, Engqvist, R, Söderberg-Naucler, C, Bergman, J. Novel indoloquinoxaline derivatives and their use in the treatment of viral infections. Canada Patent #CA2637417C (granted 2014)

Homman, M, Engqvist, R, Söderberg-Naucler, C, Bergman, J. Novel compounds and use thereof U.S Patent #20090318458A1 (granted 2011)

https://www.utu.fi/en/university/faculty-of-medicine/institute-of-biomedicine/research/infection-and-immunity

Immunometabolism unit

cesona@utu.fi

+46 70 242 7471

Viral and bacterial respiratory tract infections in children

Professor Ville Peltola, MD, PhD

Department of Paediatrics and Adolescent Medicine | Turku University Hospital | University of Turku

Key words:

Children,

respiratory tract infections,

respiratory viruses,

rhinovirus,

viral–bacterial infections

Areas of expertise

- Clinical expertise in paediatric infectious diseases
- Viral respiratory tract infections in children
- Viral–bacterial synergism
- Diagnostics of viral and bacterial infections

Research projects

- Respiratory tract infections in children: the STEPS birth cohort study
- SARS-CoV-2 infections in households with children: A cohort study
- Transcription start site analysis and MxA protein in the differential diagnosis of viral and bacterial infections in hospitalised children
- Special methodologies & techniques
- Clinical research methodologies

Collaborations

Open to new collaborations

- Laboratory research connected to clinical study questions within our areas of interest
- Companies with relevant study questions within our areas of interest

Ongoing collaborations

- Virologic, microbiological and immunologic research laboratories within the InFLAMES Flagship
- Genetic research laboratories in several locations
- Clinical research collaboration with other Nordic countries

Training to offer

- Clinical training in paediatric infectious diseases

Selected publications

Association of asthma risk alleles with acute respiratory tract infections and wheezing illnesses in young children. J Infect Dis. 2023; 3:27:jiad075. DOI: 10.1093/infdis/jiad075

Myxovirus resistance protein A as a marker of viral cause of illness in children hospitalized with an acute infection. Microbiol Spectr. 2022;10:e02031-21. DOI: 10.1128/spectrum.02031-21

Antibiotic treatments during infancy, changes in nasal microbiota, and asthma development: Population-based cohort study. Clin Infect Dis. 2021;72:1546-1554. DOI: 10.1093/cid/ciaa262

Acquisition and transmission of Streptococcus pneumoniae is facilitated during rhinovirus infection in families with children. Am J Respir Crit Care Med. 2017;196:1172-1180. DOI: 10.1164/rccm.201702-0357OC

ville.peltola@utu.fi

+358 2 313 0000

Bacterial infections: translational genomics, immunity and prevention

Professor Qiushui He, MD, PhD

Institute of Biomedicine | University of Turku

Key words:

Cytokines, diagnosis, functional antibody, pertussis, Toll-like receptors, vaccine

Areas of expertise

- Vaccine immunology
- Immunological biomarkers
- Genetic susceptibility to infectious diseases
- Molecular diagnosis and surveillance

Research projects

- Immune responses after pertussis vaccinations and infections
- Effect of genetic polymorphisms on vaccine responses
- Gut microbiome and vaccine responses in children
- Impact of genetic polymorphisms on the development of autoimmune diseases in children
- Molecular surveillance of respiratory pathogens
- Development of novel point-of-care tests

Special methodologies & techniques

- Detection of (functional) antibodies (multiplex immunoassay, ELISA, epitope mapping, CHO cell assay)
- Whole-blood stimulation by vaccine antigens, TLR ligands and recombinant interleukins
- Multiplexing (cytokines and chemokines)
- Multicolour FACS
- High-resolution melting analysis and PCR-based sequencing
- Lateral flow assay

Collaborations

Open to new collaborations

- Determination of pertussis toxin-neutralising antibodies, avidity and functional epitopes
- Novel biomarkers of inflammation and infection

Ongoing collaborations

- EUpertstrain network to study vaccine antigen deficiency of circulating *Bordetella pertussis* and its impact on vaccine effectiveness
- EU-funded PERISCOPE consortium
- Maternal pertussis immunisation
- Regulatory cytokine gene polymorphisms in pathogenesis and treatment response of juvenile idiopathic arthritis
- Genetic polymorphisms and development of recurrent respiratory infections and asthma in children

Training to offer

- Methods for analysing different pertussis toxin antibodies
- Methods to detect *B. pertussis* vaccine antigen-deficient strains
- Rapid methods for detection of macrolide resistance in *B. pertussis*

Selected publications

Immunogenicity and safety of BPZE1, an intranasal live attenuated pertussis vaccine, versus tetanus-diphtheria-acellular pertussis vaccine: a randomised, double-blind, phase 2b trial. Lancet. 2023;401(10379):843-855. DOI: 10.1016/S0140-6736(22)02644-7

Effect of immunization during pregnancy and pre-existing immunity on diphtheria-tetanus-acellular pertussis vaccine responses in infants. Emerg Microbes Infect. 2023; 4:14;2204146. DOI: 10.1080/22221751.2023.2204146

Circulation of pertussis and poor protection against diphtheria among middle-aged adults in 18 european countries. Nat Commun. 2021;12(1):2871. DOI: 10.1038/s41467-021-23114-y

Pertactin-deficient *Bordetella pertussis* isolates: evidence of increased circulation in Europe, 1998 to 2015. Euro Surveill. 2019;24(7):1700832. DOI: 10.2807/1560-7917.ES.2019.24.7.1700832

qiushui.he@utu.fi

+358 50 472 2255

Key words:

Acute appendicitis,

appendiceal microbiome,

appendicitis immunology,

complicated acute appendicitis,

uncomplicated acute appendicitis

APPAC – studies on acute appendicitis

Professor Paulina Salminen, MD, PhD

Professor of Surgery & Chief of Surgery | Turku University Hospital | Division of Digestive Surgery and Urology | University of Turku | Department of Surgery

Areas of expertise

- Acute appendicitis
- Metabolic and bariatric surgery
- Randomised clinical trials (RCTs) and prospective clinical cohort studies
- Translational research on acute appendicitis

Research projects

- APPAC I: RCT appendectomy vs. antibiotics for uncomplicated acute appendicitis; completed, follow-up ongoing
- APPAC II: RCT oral monotherapy antibiotics vs. intravenous (i.v.) followed by post-operative antibiotics (p.o.) for uncomplicated acute appendicitis; completed, follow-up ongoing
- APPAC III: pilot double-blind RCT antibiotics vs. placebo for uncomplicated acute appendicitis; completed, follow-up ongoing
- APPAC IV: double-blind RCT oral antibiotics vs. oral placebo for uncomplicated acute appendicitis in an outpatient setting; upcoming
- MAPPAC I: microbiology and immunology in uncomplicated vs. complicated acute appendicitis; recruitment completed
- MAPPAC II: microbiology and immunology in uncomplicated acute appendicitis and development of antibiotic resistance in antibiotics vs. placebo (APPAC IV substudy); upcoming

Special methodologies & techniques

- RCTs
- Shotgun sequencing
- Single-cell analysis

Collaborations

Ongoing collaborations

- National multicentre research group encompassing the majority of Finnish hospitals
- Department of Microbiology and Immunology, Turku University Hospital and University of Turku, FI
- Reetta Pentikäinen, University of Eastern Finland, FI

Selected publications

Effect of oral moxifloxacin vs. intravenous ertapenem plus oral levofloxacin for treatment of uncomplicated acute appendicitis: the APPAC II randomized clinical trial. JAMA. 2021; 325(4):353-362. DOI: 10.1001/jama.2020.23525

Antibiotics versus placebo in adults with CT-confirmed uncomplicated acute appendicitis (APPAC III): randomized double-blind superiority trial. British Journal of Surgery. 2022; 109(6):503-509. DOI: 10.1093/bjs/znac086

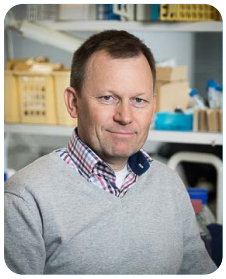
Appendiceal microbiome in uncomplicated and complicated acute appendicitis: a prospective cohort study. PLOS ONE. 2022; 17(10):e0276007. DOI: 10.1371/journal.pone.0276007

https://appac.utu.fi/

APPAC – studies on acute appendicitis group

paulina.salminen@tyks.fi

+ 358 23 130 6542



Microbiome and antimicrobial resistance

Adjunct Professor Antti Hakanen, MD, PhD, eMBA

Director of Tyks Laboratories | Turku University Hospital

Key words:

Antimicrobial resistance,

clinical microbiology laboratory,

faecal microbiota transplantation,

human microbiota

Areas of expertise

- Antimicrobial resistance (AMR)
- Human microbiota
- Specialist in clinical microbiology

Research projects

- Epidemiology and mechanisms of AMR
- Development of microbiological detection techniques
- Understanding the links between the consumption of antimicrobials and resistance
- Clinical studies to analyse human microbiota composition in different diseases and patient groups
- Clinical microbiota transplantation studies
- Immunological mechanisms controlling human microbiota in different diseases

Special methodologies & techniques

- Antimicrobial susceptibility testing and resistance detection techniques
- Collection, handling, freezing and storage of a variety of microbiota samples
- Sequencing and bioinformatics for microbial and microbiota samples
- Preparing transplants for faecal microbiota transplantations (FMT)

Collaborations

Open to new collaborations

- Epidemiology and mechanisms of AMR
- Development of microbiological detection techniques
- Human microbiota

Ongoing collaborations

- Several company collaborations in the detection of pathogens e.g. Sars-CoV-2 from different sample types
- Several academic collaborations in AMR detection and clinical studies to analyse human microbiota composition in different diseases and patient groups

Training to offer

- Advice and training in analysing and interpreting bacterial resistance to antimicrobial agents
- Advice and training in analysing and interpreting human microbiota

Selected publications

Appendiceal microbiome in uncomplicated and complicated acute appendicitis: A prospective cohort study. PLoS One. 2022;17:e0276007. DOI: 10.1371/journal.pone.0276007

Common cold in Team Finland during 2018 Winter Olympic Games (PyeongChang): epidemiology, diagnosis including molecular point-of-care testing (POCT) and treatment. Br J Sports Med. 2019;53:1093-1098. DOI: 10.1136/bjsports-2018-100487

Rapid detection of functional gene polymorphisms of TLRs and IL-17 using high resolution melting analysis. Sci Rep. 2017;7:41522. DOI: 10.1038/srep41522

Cefotaxime-resistant Salmonella enterica in travelers returning from Thailand to Finland. Emerg Infect Dis 2014;20:1214-7. DOI: 10.3201/eid2007.131744

www.tyks.fi/en/about-tyks/tyks-organization/units-excellence/centre-excellence-infections-and-microbes

Microbiome and antimicrobial resistance group

anthak@utu.fi

+358 50 400 8382

Early cancer diagnostics

Adjunct Professor Janne Leivo, PhD

InFLAMES Group Leader | Biotechnology | University of Turku

Key words:

Biomarkers, cancer, early diagnostics, extracellular vesicles, immunodiagnostics

Areas of expertise

- *In vitro* diagnostics
- Antibody development and engineering
- Biomarker discovery and validation
- Immunoassay development and clinical evaluation
- Extracellular vesicles

Research projects

- Biomarker discovery for various solid cancers
- Development of novel biomarker and assay concepts for early cancer detection
- Clinical evaluation of glycovariant assays to detect ovarian and prostate cancers
- Antibody development for various glycan antigens

Special methodologies & techniques

- Recombinant protein production and purification
- Protein labelling
- Nanoparticle coating
- Bioaffinity analysis of glycans
- Phage display

Collaborations

Open to new collaborations

- Early disease diagnostics, particularly in immunology-driven and metabolic disorders
- Extracellular vesicle-based biomarkers

Ongoing collaborations

- EU-funded MSCA-ITN project proEVLifeCycle: European multidisciplinary research and training program on extracellular vesicles in prostate cancer
- Development of diagnostic assays for the detection of bladder and gastrointestinal cancers in collaboration with Uniogen

Training to offer

- Advice on (protein) biomarker validation and clinical evaluation
- Development of immunoassays to detect novel biomarkers
- Isolation and characterisation of extracellular vesicles

Selected publications

Integrins are enriched on aberrantly fucosylated tumour-derived urinary extracellular vesicles. J. Ex. Bio. 2022; 10:e64. DOI: 10.1002/jex2.64

Diagnostic potential of nanoparticle aided assays for MUC16 and MUC1 glycovariants in ovarian cancer. Intl. Journal of Cancer 2022; 151:1175–1184. DOI: 10.1002/ijc.34111

Urinary extracellular vesicles: a position paper by the urine task force of the International society for extracellular vesicles. J. Extracell. Vesicles. 2021; 7:e12093. DOI: 10.1002/jev2.12093

Development of anti-immunocomplex specific antibodies and non-competitive time-resolved fluorescence immunoassay for the detection of estradiol. Anal. Bioanal. Chem. 2019; 411:5633-5639. DOI: 10.1007/s00216-019-01952-6

Pending patents

Islam Md, Syed P, Leivo J, Gidwani K. Use of a fuc-alpha(1-2)-gal glycan structure as a biomarker for bladder cancer #WO/2022/157422A1 (applied 2022)

https://earlycancerdiagnostics.utu.fi/

Early cancer diagnostics group

jpleiv@utu.fi

+358 44 055 5738

In vivo imaging of inflammation and cancer

Professor Anne Roivainen, PhD

Turku PET Centre | University of Turku | Turku University Hospital

Key words:

molecular imaging,

positron emission tomography,

translational research

Areas of expertise

- *In vivo* molecular imaging of inflammation and cancer, especially with positron emission tomography (PET)
- Preclinical and translational PET research from proof-of-concept studies in experimental disease models to first-in-human studies with special interest in *in vivo* imaging of inflammation

Research projects

- Development and evaluation of new targeted radiopharmaceuticals and techniques for basic research and clinical translation
- Molecular imaging of inflammatory diseases and certain cancers; multi-organ localisation and quantification of inflammation as a novel tool for early diagnosis
- Development of the new VAP-1–targeted PET radiopharmaceutical ^{68}Ga-DOTA-Siglec-9 from mouse to man, and studies thereof e.g. in patients with rheumatic diseases and certain cancers

Special methodologies & techniques

- *In vivo* molecular imaging, especially PET
- Development and evaluation of new radiopharmaceuticals

Collaborations

- Track record includes collaboration studies with Bayer Pharma, Roche, Endocyte/Novartis, GE Healthcare and Biotie Therapies.

Open to new collaborations

- Contract research with PET from experimental disease models to first-in-human studies
- Basic, preclinical and translational research where PET molecular imaging opens new dimensions for studies of diseases and drug development

Ongoing collaborations

- UCB Pharma, UK

Training to offer

- Positron emission tomography/computed tomography (PET/CT) of small animals
- Yearly organised, free-of-charge course Basics of Positron Emission Tomography

Selected publications

Efficacy and tolerability of folate-aminopterin therapy in a rat focal model of multiple sclerosis. J Neuroinflammation 2021; 18:30. DOI: 10.1186/s12974-021-02073-7

First-in-human [^{68}Ga]Ga-DOTA-Siglec-9 study, a PET ligand targeting vascular adhesion protein 1. J Nucl Med 2021; 62:577-583. DOI: 10.2967/jnumed.120.250696

Preclinical evaluation of a humanized antibody against common lymphatic endothelial and vascular endothelial receptor-1, 89Zr-desferrioxamine-bexmarilimab, in a rabbit model of renal fibrosis. J Nucl Med 2023; 64:555-560. DOI: 10.2967/jnumed.122.264725

http://inflammation-imaging.utu.fi/

In vivo imaging of inflammation and cancer group

anne.roivainen@utu.fi

+358 2 313 2862

Antibody engineering

Professor Urpo Lamminmäki, PhD

Department of Life Technologies, Biotechnology | University of Turku

Key words:

Antibody engineering,

antibody libraries,

human antibodies,

phage display

Areas of expertise

- Recombinant antibody development
- Antibody and protein engineering
- *In vitro* evolution of proteins
- Immunoassays
- *In vitro* diagnostics methods
- Protein chemistry
- Protein expression and purification
- Protein characterisation
- Immunoassays
- Design and development of synthetic antibody/protein libraries

Research projects

- Novel antibody/binder libraries including e.g. libraries of environment-sensitive antibodies for drug development
- Novel stabilised antibody fragments as components of bispecific antibodies
- Advanced screening and expression techniques to enhance recombinant antibody development
- Bispecific antibody development for neural positron emission tomography (PET) imaging
- Antibody-based tools for the efficient detection of low-molecular weight compounds

Special methodologies & techniques

- Phage display
- Mammalian cell display
- Random mutagenesis techniques

Collaborations

Open to new collaborations

- Human antibody development for therapeutic, diagnostic or research purposes
- Engineering of existing antibodies for improved properties
- Development of alternative binder proteins (such as nanobodies or DARPins)
- Development of bispecific antibodies
- Antibody humanisation

Ongoing collaborations

- Libraries to generate environment-sensitive antibodies for drug development
- Methods to enhance recombinant antibody development

Training to offer

- Phage display
- Antibody engineering

Selected publications

Selection of biophysically favourable antibody variants using a modified Flp-IOn CHO mammalian display. Front Bioeng Biotechnol. 2023; 5:9;11:1170081. DOI: 10.3389/fbioe.2023.1170081

Single-step noncompetitive immunocomplex immunoassay for rapid aflatoxin detection. 2022; 10: 30;392:133287. DOI: 10.1016/j.foodchem.2022.133287

Patents

Soukka T and Lamminmäki U. Luminescence Assay Method. U.S Patent #US8993246B2 (granted 2009)

Huovinen T, Lamminmäki U, Brockmann E-C, and Vehniäinen M. Mutagenesis method. U.S Patent #US09453216B2 (granted 2009)

Timmermand POV, Tran AT, Strand S-E, Lamminmäki UJ. Antibody polypeptides and uses thereof. U.S Patent #US11230609B2 (granted 2014)

Tran AT, Axelsson A, Malmborg Hager A-C, Sjöström K, Strand S-E, Lamminmäki UJ. Antibody polypeptides and uses thereof. U.S Patent #US11332543B2 (granted 2015)

Akter S, Vehniäinen M, Lamminmäki U. Secondary antibodies against immunocomplexes comprising cyanobacterial cyclic peptide hepatotoxins. WIPO Patent #FI20155980 (granted 2015)

Nikolov DB, Himanen J, Lamminmäki U, Sanmark H. Methods and compositions for cancer treating conditions relating to over expressions of EphA2. U.S Patent #US10501553B2 (granted 2015)

Pending patents

Lamminmäki U, Brockmann E-C, Haapalinna, A. (2022) Ultra-stable antibody fragments with a novel disulphide bridge. #FI20225887

https://antibodyengineering.utu.fi/antibodyengineering.utu.fi/

Antibody engineering group

urplammi@utu.fi

+358 50 476 5557

Radiopharmaceuticals for PET imaging

Assistant Professor Xiang-Guo Li, PhD

Principal Investigator and Deputy Radiation Safety Officer |
Turku PET Centre | University of Turku

Key words:

Biodistribution,
cancer PET imaging,
fibrosis,
lead optimisation,
PET imaging,
radiopharmaceuticals

Areas of expertise

- Development of new radiopharmaceuticals
- Radiolabelling of molecules and materials
- Radiopharmacy
- Translational positron emission tomography (PET) imaging
- Cancer and inflammation PET imaging
- PET imaging-guided lead optimisation
- Radiation safety

Research projects

- New radiopharmaceuticals for brain tumour PET imaging
- New radiopharmaceuticals for early detection of lung and bone metastasis
- Biodistribution and pharmacokinetics
- PET imaging of spinal cord injury
- PET imaging of fibrosis and inflammation
- Radiolabelling of small molecules, peptides and antibodies
- Fatty acid binding protein 3 (FABP3) targeting
- Fibroblast activation protein inhibitors
- Folate receptor targeting
- Sleep medicine

Special methodologies & techniques

- Radiolabelling
- Radiopharmacy
- PET imaging
- PET imaging-guided lead optimisation
- Radiation protection

Collaborations

Open to new collaborations

- Evaluation of pharmacokinetics and biodistribution of drug candidates with PET imaging
- Monitoring treatment response of drug candidates with PET imaging
- Disease mechanism studies with radioprobes
- Combination of radiotherapy and immunotherapy
- PET imaging-guided lead optimisation
- Sleep research

Ongoing collaborations

- Business Finland-funded projects
- Treatment and diagnostics for spinal cord injury
- Smart sleep-related product development and biomarker identification

Training to offer

- PET imaging-guided drug development
- Radiolabelling design
- Radiolabelling techniques
- PET imaging protocols
- Radiation protection

Selected publications

Aluminium fluoride-18 labeled mannosylated dextran: radiosynthesis and initial preclinical PET studies. Mol. Imaging Biol. 2023. DOI: 10.1007/s11307-023-01816-7

Folate receptor β targeted PET imaging of macrophages in autoimmune myocarditis. J. Nucl. Med. 2020; 61:1643-1649. DOI: 10.2967/jnumed.119.241356.

Adventures in radiosynthesis of clinical grade [68Ga]Ga-DOTA-Siglec-9. RSC Adv. 2018; 8:8051-8056. DOI: 10.1039/c7ra12423f

5-[^{18}F]Fluoro-5-deoxyribose, an efficient peptide bioconjugation ligand for positron emission tomography (PET) imaging. Chem. Commun. 2012; 48:5247-5249. DOI: 10.1039/c2cc31262j

Patents

O'Hagan D., Li X.-G., Method of labelling a biologically active molecule with a 5-fluoro-5-deoxypentose or a 3-fluoro-3-deoxypentose. EU Patent #EP2595666B1 (granted 2014)

https://turkupetcentre.fi/

Radiopharmaceuticals for PET imaging group

xiali@utu.fi

+358 40 512 3988

Cell fate lab

Professor Cecilia Sahlgren, Adjunct Professor, PhD

Cell and Molecular Bioscience | Åbo Akademi University |
Member of InFLAMES Executive Team

Key words:

Notch signalling,
organ-on-chip,
bioengineering,
vascular mechanics,
tumour microenvironment,
cell differentiation

Areas of Expertise

- Cell fate decisions, cell differentiation and tissue regeneration
- Mechanobiology of the cardiovascular system and cancer
- Cell signalling
- Organ-on-chip technologies
- Nanoparticle-mediated drug delivery
- Tissue engineering

Research projects

- Integration of cell signalling and mechanical forces in vascular morphology
- Tumour- and lymph node-on-chip for cancer studies
- Multilayer mechanosignalling in vascular homeostasis
- Notch counteracts replication stress to prevent cancer cell senescence
- Center of Excellence in Cellular Mechanostasis
- Center of Excellence in Bioelectronic Activation of Cell Functions

Special methodologies & techniques

- Modulation of mechanical stress *in vitro* and *in vivo*
- Organ-on-chip technologies and chip microfabrication
- Nanotechnology and biomaterials
- 3D printing
- Zebrafish as an *in vivo* model for vascular and cancer studies

Collaborations

Open to new collaborations

- Custom design and microfabrication of organ-on-chip systems for collaborative projects

Ongoing collaborations

- EU-funded "Tumor and Lymph node on Chip for cancer studies" project in collaboration with:
- Alpes Lasers S.A. (Switzerland) – advanced light source engineering
- Amires (Czech Republic) – consulting and management for research, development and innovation projects
- Asphalion (Spain) – international scientific and regulatory affairs consultancy
- Elvesys SAS (France) – flow management and microfluidic instrumentation
- PhosPrint P.C. (Greece) – laser printing systems for biomaterials
- Rayfos Ltd. (UK) – scientific software engineering and real-time processing systems
- Validation of organ-on-chip systems in collaboration with the Finnish biotechnology company Finnadvance within their Akita product line

Training to offer

- Introduction to microfabrication and mechanobiology tools available at the group, such as 3D printer, flow pumps, laser cutter and shear stress platforms

Selected publications

An N-glycan on the C2 domain of JAGGED1 is important for Notch activation. Sci Signal. 2022; 15:eabo3507. DOI: 10.1126/scisignal.abo3507

GIT1 protects against breast cancer growth through negative regulation of Notch. Nat Commun. 2022; 13:1537. DOI: 10.1038/s41467-022-28631-y

Engineered patterns of Notch ligands Jag1 and Dll4 elicit differential spatial control of endothelial sprouting. iScience. 2022; 25:104306. DOI: 10.1016/j.isci.2022.104306

A biomimetic microfluidic model to study signalling between endothelial and vascular smooth muscle cells under hemodynamic conditions. Lab Chip. 2018; 18:1607-1620. DOI: 10.1039/c8lc00286j

http://cellfatelab.github.io/

Cell fate lab

cecilia.sahlgren@abo.fi

+358 50 300 9680
(Cecilia Sahlgren)

and Research Coordinator
Kati Kemppainen

kati.kemppainen@abo.fi

Systems medicine

Professor Matej Orešič, PhD

Senior Research Fellow | Turku Bioscience Centre | University of Turku and Åbo Akademi University

Key words:

Exposome, immunometabolism, lipidomics, metabolism, metabolomics, systems biology

Areas of expertise

- Exposome research
- Metabolomics, exposomics and lipidomics platforms
- Role of gut microbiome in the regulation of host metabolism
- Integrative systems biology
- Immunometabolism

Research projects

- Inflammation in human early life: targeting impacts on life-course health (INITIALISE)
- Human exposure to per- and poly-fluoroalkyl substances — role of the gut microbiome and bile acid metabolism in mediating impact
- Translational approaches to disease-modifying therapy of type 1 diabetes
- EpiLipidNET: Pan-European Network in Lipidomics and Epilipidomics
- Blood-based metabolomics to predict severity and patient outcomes in traumatic brain injury (meTBI)
- Liver Investigation: Testing Marker Utility in Steatohepatitis

Special methodologies & techniques

- Analytical platforms for exposomics, fluxomics, metabolomics and lipidomics
- Integrative systems biology — data integration and modelling across levels of exposome, gut microbiome and host metabolism and immune system
- Genome-scale metabolic modelling

Collaborations

Open to new collaborations

- Biomarker discovery using multiomics
- Exposome studies, impacts on multiomics profiles and health outcomes

Ongoing collaborations

- EU-funded collaborative project: INITIALISE (coordinated by Oresic)
- EU-funded public–private partnerships: LITMUYS (34 academic and 20 industrial partners); INNODIA & INNODIA Harvest against type 1 diabetes (30 academic and 7 industrial partners)
- NIH-funded collaborative project: Data Infrastructure and Molecular Atlas for Alzheimer's Disease: Connecting Exposome, Gut Microbiome, and Metabolome

Selected publications

Integrative analysis of multimodal mass spectrometry data in MZmine 3. Nat Biotechnol. 2023; 4;41(4):447-449. DOI: 10.1038/s41587-023-01690-2

Dysregulation of secondary bile acid metabolism precedes islet autoimmunity and type 1 diabetes. Cell Rep Med. 2022; 10:18;3(10):100762. DOI: 10.1016/j.xcrm.2022.100762

Serum metabolome associated with severity of acute traumatic brain injury. Nat Commun. 2022; 5:10;13(1):2545. DOI: 10.1038/s41467-022-30227-5

Exposure to environmental contaminants is associated with altered hepatic lipid metabolism in non-alcoholic fatty liver disease. J Hepatol. 2022 Feb;76(2):283-293. DOI: 10.1016/j.jhep.2021.09.039

matej.oresic@utu.fi

+358 44 972 6094

Endocrine signaling

Professor Matti Poutanen, PhD

Director of Turku Center for Disease Modeling | Institute of Biomedicine | University of Turku

Key words:

Hormonal cancer,

liver steatosis,

reproduction,

sex steroid

Areas of expertise

- Sex steroid metabolism and action, steroid analytics
- Hormonal cancer
- Genetically modified mice

Research projects

- Steroid metabolism and steroid responses in eutopic and ectopic endometrium
- Personalised prevention and treatment of sclerotic bone metastases in prostate cancer
- Pathophysiology of HSD17B enzymes regulating liver lipid homeostasis

Special methodologies & techniques

- Steroid analyses
- Genetically modified mice
- Translational histopathology and digi-pathology

Collaborations

Open to new collaborations

- Steroid analytics
- Patient-derived cells
- Genetically modified mice

Ongoing collaborations

- Steroid metabolism and steroid responses in eutopic and ectopic endometrium (Organon R&D, FI)
- High content drug screening for novel treatment options for endometriosis with (Misvik Biology, FI)
- PhD co-supervision with Orion Pharma (FI)

Selected publications

Histone H3K4me3 breadth in hypoxia reveals endometrial core functions and stress adaptation linked to endometriosis. iScience. 2020; 25:104235. DOI: 10.1016/j.isci.2022.104235

A relational database to identify differentially expressed genes in the endometrium and endometriosis lesions. Sci Data. 7:284. DOI: 10.1038/s41597-020-00623-x

The lack of HSD17B3 in male mice results in disturbed Leydig cell maturation and endocrine imbalance akin to humans with HSD17B3 deficiency. FASEB J. 2020; 34:6111-6128. DOI: 10.1096/fj.201902384R

Secreted frizzled-related protein 2 (SFRP2) expression promotes lesion proliferation via canonical WNT signaling and indicates lesion borders in extraovarian endometriosis. Human Reprod. 2018; 33:817-831. DOI: 10.1093/humrep/dey026

https://ensigcon.utu.fi/

Endocrine signaling consortium

matpou@utu.fi

+358 50 366 0140

Computational biomedicine

Professor Laura Elo, PhD

Research Director | Turku Bioscience Centre | University of Turku and Åbo Akademi University; Professor | Institute of Biomedicine | University of Turku

Key words:

Artificial intelligence,

biomarkers,

computational systems immunology,

digital health,

medical bioinformatics

Areas of expertise

- Robust computational methods for proteome, epigenome and single-cell data analysis
- Next-level analysis of complex microbial samples using metaproteomics
- Computational systems immunology with applications in human T cells and immune-mediated diseases
- Artificial intelligence in the analysis of digital health data for early prediction of disease and treatment risks

Research projects

- Pushing the limits of proteomics: new computational tools for medical research
- Computational tools to reveal high-resolution single-cell signatures in health and disease
- LincRNA-orchestrated molecular regulatory networks of human immune response
- Linking informatics and genomics of helper T cells in tissues

Special methodologies & techniques

- Computational methods for high-throughput omics data, including sequencing, mass spectrometry and mass cytometry data
- Statistical and machine learning; artificial intelligence
- Data mining and modelling

Collaborations

Open to new collaborations

- Biomarker discovery using functional omics, including multi-omics
- Single-cell data analysis

Ongoing collaborations

- EU-funded public–private partnerships: INNODIA & INNODIA Harvest
- EU-funded consortia: HEDIMED and ENLIGHT-TEN+

Training to offer

- Bioinformatics consultation
- Bioinformatics journal club
- Data analysis courses and workshops

Selected publications

Benchmarking tools for detecting longitudinal differential expression in proteomics data allows establishing a robust reproducibility optimization regression approach. Nat Commun. 2022; 13(1):7877. DOI: 10.1038/s41467-022-35564-z

Type 1 Diabetes in Children With Genetic Risk May Be Predicted Very Early With a Blood miRNA. Diabetes Care. 2022; 45(4):e77-e79. DOI: 10.2337/dc21-2120

Introducing untargeted data-independent acquisition for metaproteomics of complex microbial samples. ISME Commun. 2022; 2:51. DOI: 10.1038/s43705-022-00137-0

ILoReg: a tool for high-resolution cell population identification from single-cell RNA-seq data. Bioinformatics. 2021; 37(8):1107-1114. DOI: 10.1093/bioinformatics/btaa919

Patents

Chakroborty D, Reddy EM, Elo L, Lahesmaa R, Ristimäki A, Haglund C. L1TD1 as predictive biomarker of colon cancer. WIPO # WO2019229302A1 (granted 2019)

https://elolab.utu.fi/

Computational biomedicine group

laura.elo@utu.fi

+358 50 468 0795

Cell migration

Associate Professor Guillaume Jacquemet, Docent, PhD

Cell Biology | Abo Akademi University

Key words:

Cancer cell biology,
cell migration,
deep learning,
image analysis,
microscopy

Areas of expertise

- Cancer cell biology
- Cell adhesion and migration
- Microscopy and live imaging
- Image analysis

Research projects

- The role of filopodia during breast cancer progression
- Cancer cell communication via filopodia trans-endocytosis
- Deciphering the mechanisms of pancreatic cancer metastasis
- The role of mechanosensitive calcium channels in melanoma
- The role of TLNRD1 in endothelium homeostasis
- Democratising deep learning for microscopy with ZeroCostDL4Mic

Special methodologies & techniques

- Microscopy (super-resolution microscopy, live imaging, traction force microscopy)
- Image analysis, deep learning and computer vision
- Cell and molecular biology
- Mass spectrometry (identification of protein–protein interactions using pull-downs and biotinylation-based strategy)
- Zebrafish embryo to study cancer biology
- Flow and perfusion chambers

Collaborations

Open to new collaborations

- Microscopy
- Image analysis
- Cell adhesion and migration
- The role of the cytoskeleton in health and disease

Ongoing collaborations

- Multiple ongoing collaborations with other academic labs due to our expertise in microscopy and image analysis

Training to offer

- Super-resolution microscopy and live imaging
- Image analysis

Selected publications

MYO10-filopodia support basement membranes at pre-invasive tumor boundaries. Dev Cell. 2022; 57 (20), 2350-2364. E7. DOI: 10.1016/j.devcel.2022.09.016

TrackMate 7: Integrating state-of-the-art segmentation algorithms into tracking pipelines. Nat. Methods. 2022; 19, 829–832. DOI: 10.1038/s41592-022-01507-1

Democratising Deep Learning for Microscopy with ZeroCostDL4Mic. Nat Commun. 2021; 4:15;12(1):2276. DOI: 10.1038/s41467-021-22518-0

Myosin-X and talin modulate integrin activity at filopodia tips. Cell Rep. 2021; 11:14;36(11):109716. DOI: 10.1016/j.celrep.2021.109716

https://cellmig.org/

Cell migration lab

guillaume.jacquemet@abo.fi

+358 50 323 5606

Structural immunology

Professor Tiina Salminen, PhD

Head of Structural Bioinformatics Laboratory | Biochemistry | Faculty of Science and Engineering | Åbo Akademi University

Key words:

Bacterial virulence factors,

biotherapeutics,

inhibitor design,

membrane glycoproteins,

molecular recognition,

protein–protein interactions

Areas of expertise

- Protein biochemistry
- Macromolecular crystallography
- Structural biology
- Structural bioinformatics
- Molecular interaction mechanisms in inflammation, infection and cancer
- Protein–ligand interactions
- Disease-causing genetic variation
- Structure-based drug design
- Targeted diagnostics

Research projects

- Immunosuppressive SEFIR protein as a target for new therapeutic approaches against Klebsiella infections
- Novel inhibitors of *Borrelia burgdorferi* proteins to treat Lyme disease
- Intercepting Siglec-mediated interactions in cancer and inflammation (SIGINT)
- Molecular mechanism of collagen-binding integrin activation
- Human diamine oxidase as a biotherapeutic and off-target drugs

Special methodologies & techniques

- Modern facilities for protein purification and sample quality control
- State-of-the-art infrastructure for protein crystallisation
- Automated imaging of protein crystallisation trials
- *In situ* diffraction testing
- Up-to-date infrastructure for computational biology
- Scientific IT support

Collaborations

Open to new collaborations

- Structural biology projects related to inflammation, infection and cancer
- Structural bioinformatics projects related to inflammation, infection and cancer
- Scientific IT support

Ongoing collaborations

- Structural biology projects
- Structural bioinformatics projects
- Scientific IT support
- Training to offer
- Structural biology (basic protein biochemistry knowledge a prerequisite)
- Structural bioinformatics

Selected publications

Heparin-binding motif mutations of human diamine oxidase allow the development of a first-in-class histamine-degrading biopharmaceutical. Elife. 2021; 10:e68542. DOI: 10.7554/eLife.68542

Novel Small Molecule Hsp90/Cdc37 Interface Inhibitors Indirectly Target K-Ras-Signaling. Cancers. 2021; 13, 927. DOI: 10.3390/cancers13040927

Structural and biomolecular analyses of *Borrelia burgdorferi* BmpD reveal a substrate-binding protein of an ABC-type nucleoside transporter family. Infect Immun 88(4):e00962-19. DOI: 10.1128/IAI.00962-19

Novel Pyridazinone Inhibitors for Vascular Adhesion Protein-1 (VAP-1): Old target - New Inhibition Mode. J Med Chem. 2013; 56: 9837-48. DOI: 10.1021/jm401372d

Patents

Salminen T, Airenne T, Johnson M, Kidron H, Nymalm Y, Söderholm A, Smith D, Pihlavisto M, Viitanen L, Pentikäinen O, Nyrönen T. Crystalline VAP-1 and uses thereof. EU patent #EP1633861A1 (granted 2004)

Hirvelä L, Johansson N, Koskimies P, Pentikäinen O, Nyrönen T, Salminen T, Johnson MSJ. Novel compounds and their use in therapy. EU Patent #EP 1 635 839 (granted 2004). U.S Patent #8,080,540 (granted 2011)

https://www.abo.fi/en/structural-bioinformatics-laboratory/

Structural immunology lab

tiina.salminen@abo.fi

+358 40 515 3941

Functional materials for medicine

Professor Hongbo Zhang, PhD

Pharmaceutical Sciences Laboratory | Åbo Akademi University

Keywords

Drug delivery,

macromolecular delivery,

microfluidics,

nanomaterials,

tissue engineering

Areas of expertise

- Nanotechnology and biomaterials
- Different nanosystems were designed according to clinical requirements
- Biomimetic mineralisation/encapsulation
- Construction of materials for tissue engineering

Research projects

- Bioencapsulated mitochondrial transplantation to treat diseases
- Application of advanced functional materials for CRISPR/Cas9 delivery
- Multifunctional DNA formulation for gene therapy
- Advanced functional materials in tumour detection
- Advanced functional materials in delivery of cell growth factors and construction of tissue engineering materials

Special methodologies & techniques

- Multi-channel microfluidic technology
- Bioencapsulation or mineralisation technology

Collaborations

Open to new collaborations

- Mitochondrial biology researchers
- Immunologists, especially linking tumour metabolism with immunity

Ongoing collaborations

- Collaboration with Professor David A. Weitz from the Department of Engineering and Applied Sciences at Harvard University (US) to develop multifunctional nanomedicine materials based on microfluidics
- Collaboration with Professor Hélder A. Santos from the University Medical Center Groningen/University of Groningen (NL) to design porous silicon nanomaterials for biomedical applications
- Study on reducing immune rejection of lung transplantation in cooperation with the Department of Lung Transplantation, Affiliated Hospital of Jilin University (CN)
- Collaboration with the research group from the Nephrology Center of the First Affiliated Hospital of Zhejiang University Medical College (CN) to develop a nanosystem preventing immune response after kidney transplantation
- Cooperation with a team from the Otolaryngology Institute at the Eye, Ear, Nose and Throat Hospital of Fudan University (CN) to develop novel materials to deliver the CRISPR/Cas9 system for deafness treatment

Training to offer

- Introduce multi-functional martials based on their clinical demand and provide training for different formulation syntheses

Selected publications

Helper T cell (CD4+) targeted tacrolimus delivery mediates precise suppression of allogeneic humoral immunity. Research. 2022; 9794235. DOI: 10.34133/2022/9794235

In vivo kidney allograft endothelial specific scavengers for on-site inflammation reduction under antibody-mediated rejection. Small. 2022; 18, 2106746. DOI: 10.1002/smll.202106746

Microfluidic-assisted biomineralization of CRISPR/Cas9 in near-infrared responsive metal-organic frameworks for programmable gene-editing. Nanoscale. 2022; 14, 15832-15844. DOI: 10.1039/d2nr04095f

Improving the knock-in efficiency of MOF-encapsulated CRISPR/Cas9 system through controllable embedding structures. Nanoscale. 2021; 13, 16525-16532. DOI: 10.1039/d1nr02872c10.1039/d1nr02872c

Patents

Encapsulated bioactive mitochondria. Finland Patent #FI2021585 (granted 2021)

https://www.pharmscilab.fi/nanoprecisionmed

Functional materials for medicine lab

hongbo.zhang@abo.fi

+358 50 306 1491

Computer-aided drug discovery

Professor Olli Pentikäinen, PhD

Institute of Biomedicine | University of Turku

Key words:

Computer-aided drug discovery,

modulator,

protein–protein interaction modulator,

small molecule

Areas of expertise

- Computer-aided drug discovery
- Identification of small molecule protein–protein interaction modulators
- Entrepreneurial experience: Founder/Co-founder of two contract research organizations (CROs)
- Method development for drug discovery

Research projects

- Development of efficient methods for protein–protein interaction drug discovery
- Discovery of modulators for e.g. CIP2A, K-RAS G12D, K-RAS G12D, EGFR and HER3
- Molecular mechanism of SYNGAP1 in health and disease

Special methodologies & techniques

- Traditional computer-aided drug discovery methods, such as docking, molecular dynamics simulations and in-house–developed technology
- Novel discovery platforms for protein–protein interaction modulator discovery
- Synthesis of small molecules and macrocyclic compounds

Collaborations

Open to new collaborations

- Small molecule discovery
- Joint development of novel artificial intelligence (AI)-based technology for molecular discovery

Ongoing collaborations

- Open-source software development for molecular discovery
- Computational chemistry knowledge exchange

Selected publications

Blocking oestradiol synthesis pathways with potent and selective coumarin derivatives. J Enzyme Inhib Med Chem. 2018; 33:743. DOI: 10.1080/14756366.2018.145291 9

Substrate selectivity of coumarin derivatives by human CYP1 enzymes: *in vitro* enzyme kinetics and *in silico* modeling. ACS Omega. 2021; 6:11286. DOI: 10.1021/acsomega.1c00123

Optimization of cavity-based negative images to boost docking enrichment in virtual screening. J Chem Inf Model, 2022; 62: 1100. DOI: 10.1021/acs.jcim.1c01145

Virtual screening strategy to identify retinoic acid-related orphan receptor γt modulators. Molecules. 2023; 28:3420. DOI: 10.3390/molecules28083420

Patents

Several patents such as:

Hirvelä L, Johansson N, Koskimies P, Pentikäinen OT, Nyrönen T, Salminen TA, Johnson MS, Lehtovuori P, Saarenketo P, van Steen BJ, Thole H-H, Unkila M, Messinger J, Kiviniemi J, Pirkkala L, Husen. B. Compounds and their use in therapy. U.S. Patent #7,524,853 (granted 2009)

Pending patents

Linnanen T, Hirvelä L, Illikainen K, Hakola M, Niinivehmas S, Pentikäinen O, Stjernschantz C. Novel heterocyclic compounds, compositions, methods of preparation and uses thereof. WIPO Patent #WO/2022/234193 (applied 2022)§

Lilja J, Ivaska J, Pentikäinen O, Niinivehmas S. Therapy of RAS-dependent cancers. WIPO Patent #WO/2021/160937 (applied 2021)

olli.pentikainen@utu.fi

+358 40 521 6913

Business development and innovation services

Adjunct Professor Anne Marjamäki, PhD

Business Development Manager, Innovation Services, Research Affairs |
University of Turku | Member of InFLAMES Executive Team

Key words:

Invention,
invention disclosure,
patent,
start-up, exploitation

Areas of Expertise

- Idea propositions and invention disclosures
- Patenting process and management of University intellectual property (IP) portfolio
- Support for research funding targeting commercialisation of research results
- Commercialisation of research: sale and licensing agreements
- Research based spin-offs/start-ups

Research projects

- Innovation Services is currently working with several projects targeting research commercialisation (Business Finland Research-to-Business projects)

Collaborations

- University of Turku has sale and licensing agreements with several pharma and diagnostic companies
- University of Turku has a partnership model; a few are strategic partners – significant and extensive collaborators – whereas others are university level collaborators. Pharma and diagnostic companies are well represented
- Innovation Services/University of Turku works closely with local and national innovation ecosystems

Patents

As of 2022, Innovation Services is managing 52 patent families, 112 granted patents and 297 pending patent applications.

innovations@utu.fi | anmamar@utu.fi +358 40 565 8378

Health economics

Professor Mika Kortelainen, PhD

Department of Economics | Turku School of Economics | University of Turku

Key words:

Competition, cost-effectiveness, economics, pharmaceutical price regulation, quasi-experiments

Areas of expertise

- Health economics
- Healthcare financing
- Competition in healthcare markets
- Pharmaceutical price regulation

Research projects

- Competition and provider incentives in healthcare markets
- Effects of competition and regulation on the pharmaceutical market in Nordic countries
- Effect of education on health behaviour and well-being
- Formation of a competitive advantage in the private health service sector

Special methodologies & techniques

- Causal inference with observational data
- Economic evaluation of healthcare technologies
- Quasi-experimental research designs

Collaborations

Open to new collaborations

- Economic evaluation of healthcare technologies
- Digital tools in healthcare
- Training to offer
- Health economics
- Quasi-experimental methods

Selected publications

The indirect effect of mRNA-based Covid-19 vaccination on unvaccinated household members. Nature Communications. 2022; 13: 1162. DOI: 10.1038/s41467-022-28825-4

The long-run effects of cesarean sections. Journal of Human Resources. 2022; 57(6), 2048-2085. DOI: 10.3368/jhr.58.2.0719-10334R1

Cost-effectiveness of whole-exome sequencing in progressive neurological disorders of children. European Journal of Paediatric Neurology. 2022, 36: 30-36. DOI: 10.1016/j.ejpn.2021.11.006

mika.kortelainen@utu.fi +358 50 308 2642

InFLAMES administrative and support team

General inquiries can be directed to inflames@utu.fi.

Specific contacts for project management, research funding, and communication are listed with emails and phone numbers.

University of Turku

Kaisa Hakkila, PhD

Project manager

+358 50 526 7057

kaisa.hakkila@utu.fi

Project management, stakeholder collaboration

Sampo Koivunen

Research Coordinator

+358 50 599 7637

sampo.koivunen@utu.fi

Education, General InFLAMES coordination

Jarkko Koivunen, PhD

Research manager

+358 50 449 4932

jarkko.koivunen@utu.fi

Research funding, industry engagement

Joe Hettinger, PhD

Research Manager

+358 50 452 4166

joe.hettinger@utu.fi

Research funding, industry engagement

Liisa Koivula

Communication, Media relations

+358 50 594 7694

liisa.koivula@utu.fi

Communication Specialist

Åbo Akademi University

Kati Kemppainen, PhD

Project Coordinator

+358 50 473 3923

kati.kemppainen@abo.fi

General InFLAMES coordination

Johanna Toivonen de Gonzales, PhD

Grant writer, Research Specialist

+358 50 409 91 77

johanna.toivonendegonzales@abo.fi

Research funding

InFLAMES
Solution is in Immunity

Research portfolio 2026 - 2028

InFLAMES Research Flagship

Innovation Ecosystem Based on the Immune System

The InFLAMES Research Portfolio 2026–2028 presents an extensive overview of the InFLAMES Research Flagship, a joint initiative of the University of Turku and Åbo Akademi University in Finland. As part of the Research Council of Finland's Flagship Programme, InFLAMES unites academic excellence with innovation, aiming to transform cutting-edge immunological research into practical health, societal, and economic solutions.

Research Council of Finland

UNIVERSITY OF TURKU

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