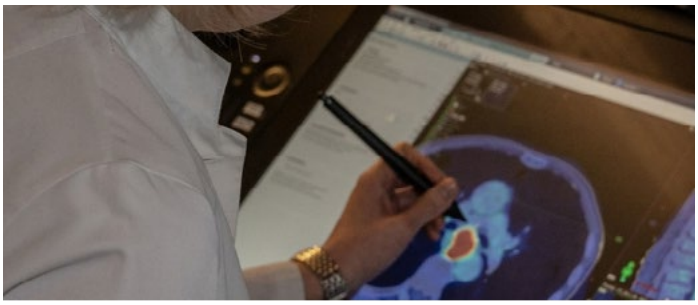
Tyks Cancer Centre Annual Report

2021

TYKS



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Finnish Cancer Research - Expert Catalogue

The Expert Catalogue is a digital matchmaker tool for medical and biomedic professionals to support new collaborations.

OECI CANCER CENTRE

Content

Tyks Cancer Centre / Turku University Hospital Tyks

In November 2019 the Tyks Cancer Centre was approved as the Organization of European Cancer Institutes (OECI) Cancer Centre.

Cancer Centre status means that TYKS meets high quality standards of cancer care, of how cancer care is organized and of cancer research in Europe.

In 2021, TYKS has adhered closely to the improvement proposals of the audit. The institutional cancer strategy has been adjusted and the same holds for research strategy in general. Dashboards for cancer care and management have been introduced.

The Tyks Cancer Centre is at the heart of all patient-centered cancer care and of the research cluster. Together with the network of the Western Finland Cancer Centre (FICAN West) – which includes the central hospitals of Pori (Satasairaala) and Vaasa and the Turku University Cancer Research Laboratories – it will be one of the leading centers of cancer care and science in Finland. The members of the Tyks Cancer Board (Clinical) represent all departments with operational responsibility for cancer care in this region.

We are committed to continuous development of patient-centered care. Our main development areas will focus on further developing the institutional governance related to clinical cancer care and research. An executive committee of the Tyks Cancer Board has been established. Its main task is to reinforce the collaboration related to decision-making, implementation of cancer care and cancer research across TYKS and the University of Turku. The members of this executive committee have been nominated by the CEO of TYKS and they represent the main heads of the departments involved in cancer treatment and research. The executive board operates in close collaboration with the Cancer Board (Clinical) and the Scientific Cancer Board which together cover all heads of departments and research directors involved in cancer treatment and research.

There have been many challenges concerning cancer care and clinical research during the year 2021. Covid pandemic has changed working conditions, for instance updated digitalization in meetings, of which many can be arranged via Teams or Zoom. On the other hand, we know that there is 30 % decrease in the amount of cancer diagnoses, probably due to patients scare to take part into the screening programs and difficulties in seeking care for diagnosis under covid epidemic. Our mission is to see that this problem is taken very seriously, and patients are offered the help they need.

Matti Bergendahl
MD, PhD, Director of Hospital District of Southwest Finland and Chair of FICAN West Board

Petri Virolainen,
MD, PhD, CEO of Tyks Hospital and Chair of the Executive Committee of Tyks Cancer Board

Prof. **Heikki Minn**,
MD, PhD, Department of Oncology and Radiotherapy (Head) and Research Director (Clinical)

Prof. **Panu Jaakkola**,
MD PhD, Head of cancer research laboratories and Chief physician, FICAN West

Pia Vihinen,
MD, PhD, Chief physician, Director of FICAN West

Mervi Siekkinen,
RTT, PhD, Development Manager of FICAN West

Oncology at TYKS from 1980's to today

I have been privileged to witness the incredible advances in diagnosis and treatment of cancer over more than three decades. As an oncology resident during the late 1980s I remember the various multidrug cocktails I carefully administered to ward patients while it was made clear that metastatic disease was incurable with the rare exception of testicular cancer. When in early 1990s I learned the principles and practice of radiotherapy I was on spot to observe how big difference computed tomography (CT) made for calculation of dose distribution, although conformal techniques which could avoid irradiation of normal tissues were then far from perfect.

Coming back from my post-doc in Michigan in 1994 things started to accelerate. One of the key matters I saw when comparing the US and Finland was the fact that we could adapt here rapidly all oncologically important innovations. To the benefit of our patients, we kept in pace with introduction of biologic molecularly targeted compounds such as rituximab, trastuzumab, imatinib, antiangiogenic drugs, and monoclonal antibodies against epidermal growth factor. Together with conventional chemotherapy

and endocrine therapy these magic bullets would offer unprecedented tumour control and turn to cure some cases where former management was regarded at best as growth retarding.

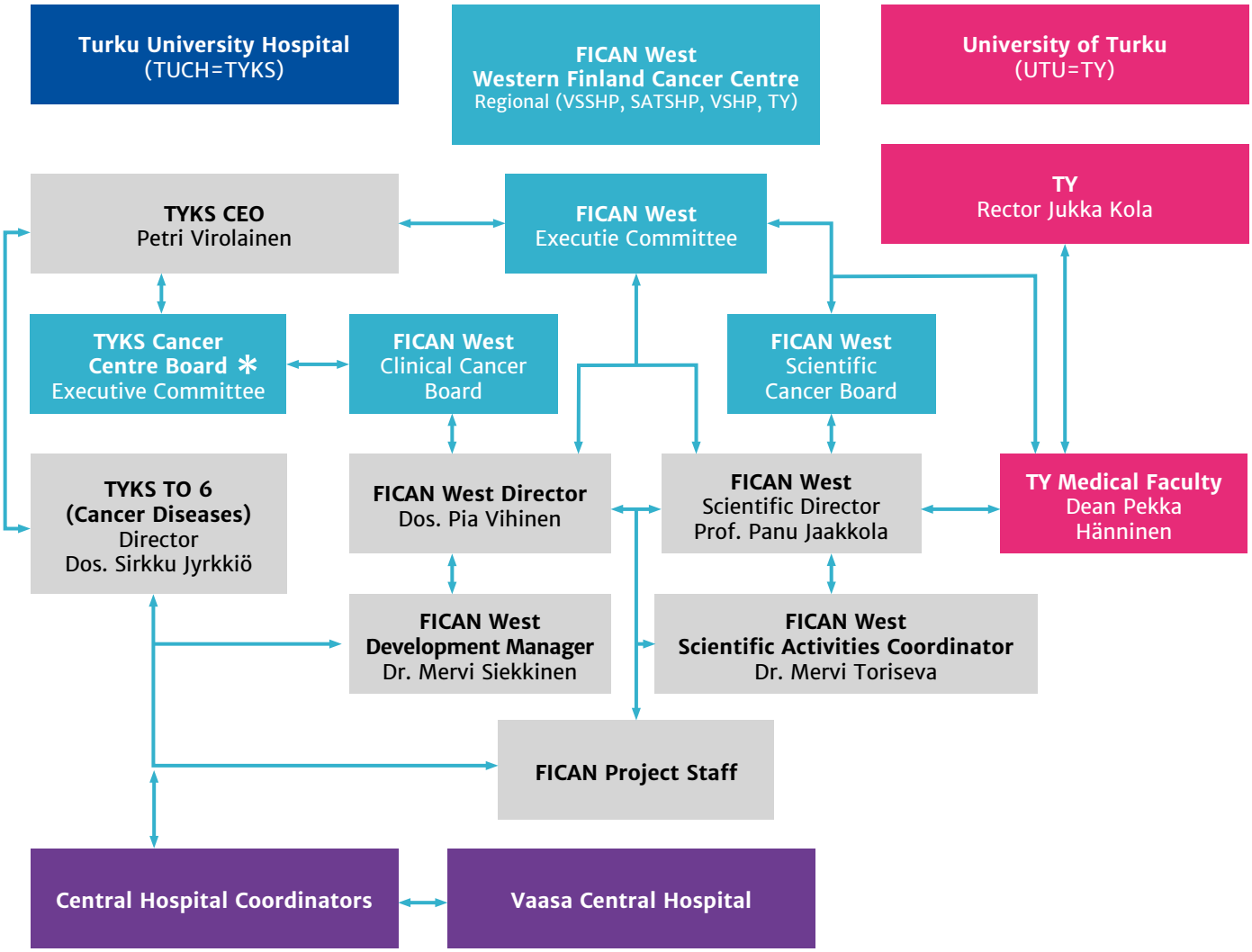
In parallel with medical oncology, radiotherapy has performed great right from the beginning of this millennium. Many acronyms such as IMRT (intensity modulated radiotherapy), IGRT (image guided radiotherapy), VMAT (volumetric arc therapy), and SABR (stereotactic ablative body radiotherapy) have become commonplace and hybrid positron emission tomography/CT and multiparametric magnetic resonance imaging (MRI) are available for routine visualisation of multiple layers of treatment volumes. FICAN West in Turku was proud to start among the first in Nordic countries MRI-only radiotherapy which can replace CT both for target delineation and dose planning in certain anatomic locations.

What's coming next? Immuno-oncology is a major breakthrough to control metastatic cancer after some less successful efforts during the previous century. Precision oncology is taking major leaps when organ-based management strategies are replaced by direct identification of molecular targets. In the evolution of cancer rapid sequencing of whole genome from tissue and blood may guide treatment and surveillance algorithms leaving less guess work for prediction of response than ever before. Digital platforms have emerged to assist traditional face-to-face interaction between the patient and medical professionals. I need to mention advances in translational research and give credit to increased collaboration between basic scientists and clinicians. Within FICAN West multidisciplinary tumour boards are presently active in all major cancers where anti-cancer treatment, psychosocial aspects, rehabilitation and palliation all deserve an important part of the team work.

In Finland the five year cancer-specific survival approaches 70 %. This is a very high figure according to European and global standards. Although aging population, soon changing public health care system and high costs may throw shadows to this inspiring achievement I am confident that we can raise the figure in the future further if we keep us on the current good course.

Heikki Minn, Professor, Department of Oncology and Radiotherapy.

Organizational structure



*Tyks Cancer Centre Board (Executive)

Pia Vihinen MD, Director, FICAN West
Petri Virolainen MD, CEO, TYKS (Chair)
Arto Rantala MD, Director, Division of Digestive Surgery and Urology
Markku Kallajoki MD, Prof, Head, Department of Pathology
Heikki Minn MD, Prof, Head, Department of Oncology and Radiotherapy
Sirkku Jyrkkiö MD, Director, Division of Surgery and Oncology
Maija Itälä-Remes MD, Head, Department of Hematology
Ritva Kosklin RN, Head Nurse, Division of Surgery and Oncology
Mervi Siekkinen, PhD, Development Manager, FICAN West (Secretary)

Clinical Cancer Board Members of TYKS, Satasairaala and Vaasa Central Hospital

Adj. prof. **Pia Vihinen** MD, PhD, Director, FICAN West (chair)
Adj. prof. **Sirkku Jyrkkiö**, MD, PhD, Director, Division of Surgery and Oncology, TYKS
Heikki Minn, MD, PhD, Prof, Head, Department of Oncology and Radiotherapy, TYKS
Adj. prof. **Arto Rantala** MD, PhD, Director, Division of Digestive Surgery and Urology, TYKS
TYKS
Markku Kallajoki, MD, PhD, Prof, Head, Department of Patology, TYKS
Maija Itälä-Remes, MD, PhD, Prof, Head, Department of Hematology, TYKS
Ritva Kosklin Head Nurse, Division of Surgery and Oncology, TYKS
Adj. prof. **Sakari Hietanen** MD, PhD, Head, Department of Gynecologic Oncology, TYKS
Prof. **Jaakko Rinne** MD, PhD, Director, Division of Neurocentre, TYKS
Adj. prof. **Päivi Lähteenmäki** MD, PhD, Head, Dep. of Pediatrics and Adolescent Hematology and Oncology, TYKS
Adj. prof. **Riitta Parkkola** MD, PhD, Head, Department of Medical Imaging, TYKS
Kalevi Pulkkanen MD, PhD, Head, Department of Oncology, Satasairaala
Tuula Huumonen Head Nurse, Department of Oncology, Satasairaala
Prof **Antti Jekunen,** MD, PhD, Head, Department of Oncology, Vaasa Central Hospital
Tiia Sirkola Head Nurse, Department of Oncology, Vaasa Central Hospital
Mervi Siekkinen, PhD, Development Manager, FICAN West (Secretary)

Other operational experts of TYKS

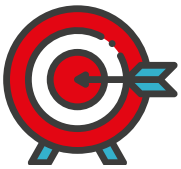
Adj. prof. **Vesa Anttila** MD, PhD, Head, Department of Cardiothoracic Surgery, TYKS
Adj. prof. **Peter Boström** MD, PhD, Head, Department of Urology, TYKS
Tarja Horn Head Nurse, Division of Digestive Surgery and Urology, TYKS
Adj. prof. **Heikki Irjala** MD, PhD, Head, Department of Head and Neck Surgery, TYKS
Adj. prof. **Marita Kilpeläinen** MD, PhD, Head, Department of Pulmonary Diseases, TYKS
Adj. prof. **Ilkka Koskivuo** MD, PhD, Head, Department of Plastic Surgery, TYKS
Adj. prof. **Veli-Matti Kähäri** MD, PhD, Head, Department of Dermatology, TYKS
Anne Laapotti-Salo Head Nurse, Division of Medicine (Hematology), TYKS
Adj. prof. **Tero Soukka** MD, PhD, Head, Department of Oral and Maxillofacial Diseases, TYKS
Outi Tuominen PhD, Head Nurse, Division of Pediatrics and Adolescent cancer, TYKS
Leila Varakas, Head Nurse, Division of Obstetrics and Gynecology, TYKS

Scientific Cancer Board Members

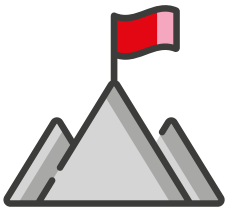
Prof. **Panu Jaakkola**, MD, PhD, UTU, TYKS, Department of Oncology, Chief physician, FICAN West
Prof. **Tero Aittokallio**, PhD, UTU, Statistics and Applied Mathematics
Adj. prof. **Peter Boström**, MD, PhD, TYKS, Department of Urology, Chief physician
Prof. **Klaus Elenius**, MD, PhD, UTU, Medical Biochemistry, Turku Bioscience
Prof. **Laura Elo**, PhD, UTU, Turku Bioscience
Pauliina Hartiala, MD, PhD, TYKS, Department of Plastic Surgery
Adj. prof. **Sakari Hietanen**, MD, PhD, TYKS, Department of Gynecological Cancer
Adj. prof. **Maija Hollmén**, PhD, UTU, MediCity Research Laboratories
Adj. prof. **Riikka Huovinen**, MD, PhD, TYKS, Department of Oncology and Radiotherapy
Prof. **Pekka Hänninen**, PhD, UTU, Dean of Medical Faculty
Prof. **Maija Itälä-Remes**, MD, PhD, TYKS, Department of Hematology
Prof. **Johanna Ivaska**, PhD, UTU, Turku Bioscience
Prof. **Antti Jekunen**, MD, PhD, Department of Oncology and Radiotherapy, Vaasa Central Hospital and UTU
Adj. prof. **Jani Keyriläinen**, PhD, TYKS, Department of Medical Physics
Adj. prof. **Ilpo Kinnunen**, MD, PhD, TYKS, Department of Head and Neck Cancer Surgery
Prof. **Veli-Matti Kähäri**, MD, PhD, UTU, TYKS, Department Dermatology
Prof. **Riitta Lahesmaa,** MD, PhD, UTU, Turku Bioscience, Director
Adj. prof. **Päivi Lähteenmäki,** MD, PhD, TYKS, Department of Pediatrics and Adolescent Cancer and Karolinska Sjukhuset
Prof. **Heikki Minn**, MD, PhD, TYKS, Department of Oncology and Radiotherapy and UTU
Prof. **Kim Pettersson**, PhD, UTU, Biotechnology, Department of Biochemistry
Prof. **Matti Poutanen**, PhD, UTU, Physiology and Turku Center for Disease Modeling
Kalevi Pulkkanen, MD, PhD, Satasairaala, Department of Oncology, Chief physician
Eeva Rainio, PhD, UTU, Head of faculty development
Adj. prof. **Taneli Saariaho**, MD, PhD, TYKS Department of Pulmonary Diseases
Prof. **Paulina Salminen**, MD, PhD, UTU, TYKS, Department of Surgery
Prof. **Johanna Schleutker**, PhD, UTU and TYKS, Medical Genetics, Head Geneticist
Mervi Siekkinen, PhD, TYKS and FICAN West, development manager
Adj. prof. **Maria Sundvall**, MD, PhD, UTU, TYKS, Department of Oncology and Radiotherapy
Adj. prof. **Pekka Taimen**, MD, PhD, UTU, TYKS, Department of Pathology, Chief pathologist
Mervi Toriseva, PhD, UTU, Institute of Biomedicine, TYKS, FICAN West, research coordinator, secretary
Adj. prof. **Pia Vihinen**, MD, PhD, TYKS, Department of Oncology and Radiotherapy and FICAN West, Director
Prof. **Jukka Westermarck**, MD, PhD, UTU, Turku Bioscience

Tyks Cancer Centre Strategy 2018-2022

The Tyks Cancer Centre Strategy 2018-2022 constitutes a strategic plan of the future, which will guarantee the population of the region high-quality and efficacious treatment of cancer, research and education in the context of a center of excellence to be.



VISION: The Tyks Cancer Centre is an internationally acknowledged quality center which produces evidence-based cancer treatment and high-level scientific research in a timely manner in an environment where the personnel has a high level of wellbeing.



MISSION: The Tyks Cancer Centre is the heart of the cancer care and research cluster together with the network of the Western Finland Cancer Centre (FICAN West), which includes the central hospitals in Pori and Vaasa and the Turku University Cancer Research Laboratories, it will be one of the leading centers in Finnish cancer care and research.

Assets and specialties of the Tyks Cancer Centre

- The Tyks Cancer Centre has all diagnostics and treatments available in Finland to be used to the benefit of cancer patients.
- Highly specialized development in personalized medicine and genomic diagnostics. The Auria Biobank and the clinical information unit provide a unique setting that makes it possible to combine information on tumor molecular biology with patient records, a combination that will provide real-world evidence data for daily practice and research. The hospital campus area harbors one of the leading PET centers in Europe and the Auria Biobank for collection, storage and advanced research on biological specimens.
- Multilingual, highly competent professionals. Cancer care is routinely provided in Finnish or Swedish.
- The leading stem cell transplantation unit in Finland.
- Basic cancer research and clinical research are combined and form the FICAN West Research network located in the same campus area. More than 100 cancer-oriented biotechnology companies at the same campus generate and develop research innovations from bench to bedside.
- Nursing science research is integrated into a program of the Tyks Cancer Centre called Psychosocial care and survivorship care of cancer patients.
- All facets of cancer care and research are easily reached within the campus area.

Tyks Cancer Centre: Key strategic measures 2018-2022

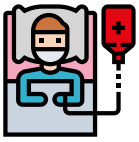
1. Strengthen the involvement of patients in their treatment.
2. Develop standardized and equal treatment facilities for all patients.
3. While supporting centralized treatment planning clinical cancer treatment is facilitated close to the home of the patient and in the vernacular of the patient. Increase work-sharing with central hospitals and the primary health service.
4. Support out-patient treatment.
5. Establish a palliative and supportive cancer care unit at Tyks.
6. Develop biological imaging and PET imaging of cancer with new tracers.
7. Strengthen the research network among FICAN West partners, start Phase I clinical trials and strengthen the involvement with the Nordic Network for Early Cancer Trials (NECT).
8. Increase the number of clinical trials in the most common cancer groups (breast cancer, prostate cancer, lung cancer) and improve patient accrual to trials.
9. Develop further the key cancer care areas of the FICAN: personalized medicine and supportive care.
10. Establish nationwide quality registers of cancer treatment and develop solutions for electronic follow-up and contact with patients.
11. Establish institutional governance for the Tyks Cancer Centre.
12. Increase the overall knowledge on cancer diseases and treatment facilities in Finland in collaboration with other FICAN partners.

Core activity data 2021

Diagnosed (new) patients 6136

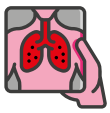
Radiotherapy patients 1517

Outpatient appointments 122 106

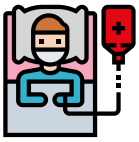


Chemotherapy patients 3365

Radiotherapy fractions 25680



Total number of medical imaging studies 16205 (X-ray, MRI, PET, PET-MRI, PET-CT, CT)



Chemotherapy (new) 6074

Ward care periods 6905

Molecular pathological studies 6825

Radiotherapy treatments 1555

Ward care days 23404

Relative survival

The data on the relative survival of patients treated at the Turku Cancer Centre are shown in the following table. Survival data originates from the Finnish Cancer Registry (www.cancerregistry.fi).

Five-year relative, age-standardized survival in patients diagnosed 2017-2019 for the five most common cancer diagnoses in Finland and for cutaneous melanoma by gender. The number of patients diagnosed at the Hospital District of Southwest Finland area (year 2019) are also shown.

ICD-10	Tumor location	Gender	5-year survival Finland 2017–2019	5-year survival FICAN West 2017-2019	Patients (n) FICAN West 2019
C50	Breast	Female	91.09 (90.37-91.82)	89.67 (87.91-91.48)	861
C18-20	Colon		69.03 (67.32-70.78)	70.37 (66.48-74.49)	284
C54	Uterus		81.54 (79.57-83.57)	80.73 (76.11-85.64)	144
C33-34	Lung		20.82 (19.29-22.48)	19.95 (16.25-24.49)	196
C43	Melanoma		93.75 (91.75-95.79)	90.22 (85.40-95.31)	145
C65-68	Urinary tract		68.85 (65.01-72.92)	69.61 (61.33-79.01)	52
C61	Prostate	Male	93.59 (92.67-94.52)	92.82 (90.78-94.91)	905
C18-20	Colon		64.21 (62.45-66.01)	63.93 (59.97-68.16)	345
C33-34	Lung		13.18 (12.18-14.27)	11.97 (9.77-14.66)	315
C65-68	Urinary tract		74.36 (71.92-76.88)	69.10 (63.91-74.71)	202
C43	Melanoma		91.93 (89.81-94.11)	91.02 (85.87-96.48)	138

Quality system

Quality management means operative leadership, assessment and improvement aimed at reaching preset quality goals.

The goal of the quality management plan of the Hospital District of Southwest Finland for 2021 is to support systematic and continuous development of quality and patient safety. The quality management plan is based on national legislation, organizational strategy, operative quality goals and on systematic assessment and continuous improvement of what is done.

In general, the SHQS quality program is used by all departments in the TYKS hospital that manage cancer patients. In addition, the work done within the TYKS laboratory functions (clinical chemistry, hematology, pathology and genetics) are accredited clinical laboratory activities (e.g., ISO1518). Medical imaging (clinical neurophysiology, clinical physiology, nuclear medicine, and – within PET – also production of radiopharmaceuticals) are accredited diagnostic functions (e.g., EN ISO / IEC 17025: 2017, FINAS). An external clinical audit of the use of medical radiation in the department of nuclear medicine, in the PET center and in radiotherapy (Labquality), has been carried out, as required by the Radiation Act.

Measures of quality of care and follow-up

Together with TYKS Information Service, with 2M-IT and with the Finnish Cancer Registry, FICAN West coordinates the development of cancer quality registries and a dashboard so that they support clinical work and the monitoring of the treatment effectiveness more effectively and facilitate scientific research. When a unified operative model is created, indicators of quality and follow-up must also be determined.

Quality registry

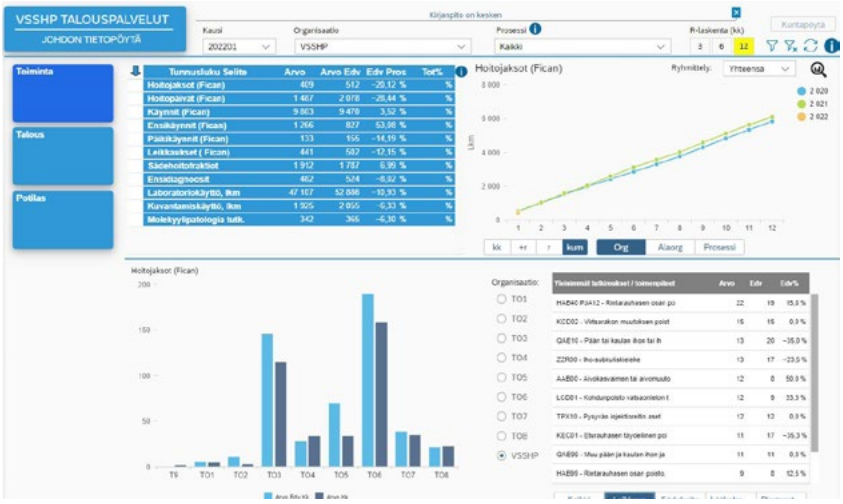
A central part of the quality register for cancer treatment and research is the national Finnish Cancer Registry. The Finnish Cancer Registry automatically receives information about new cases of cancer, histologically confirmed. The challenge is to create comprehensive clinical reports. The aim of the Cancer Registry is to expand the registry to allow for extensive clinical and epidemiological research.

The Hospital District of Southwest Finland has previously exposed the quality registry suppliers to competition, and BCB Medical has been selected. BCB Medical's quality registers are used in the university hospital, for example in orthopedics, colorectal surgery and urology. FICAN West works on a national level closely with other cancer centers, including the Finnish Cancer Registry, with the aim of improving coverage of the information of the entries of the Finnish Cancer Registry.

Several surgical disciplines have introduced (e.g., orthopedics) or are in the process of introducing (e.g., gastric surgery, chest surgery, urology) quality registers for improved follow-up of the patient's condition, treatment and – most importantly – treatment effectivity. Quality registers, when implemented in surgery, are expected to unify the way operative reports are generated. Currently, systems are in place for collection of information on adverse events experienced by patients receiving oncological drugs and on disease follow-up (this is the case, e.g., in gynecology, hematology, lung diseases, pediatrics, oncology and urology). This has been made possible through modern technology which allows commercial companies or the Health village system to analyze data.

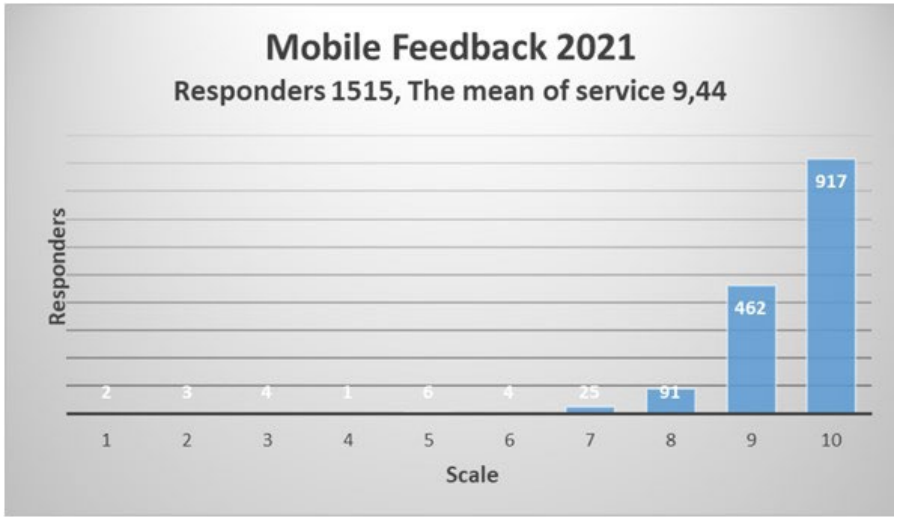
Dashboard

FICAN West has, in collaboration with the units of the Turku university central hospital that treat cancer patients, developed a dashboard for the administration. The dashboard covers a major section of the traditional parameters of daily administrative tasks and facilitates cancer treatment follow-up in the hospital.

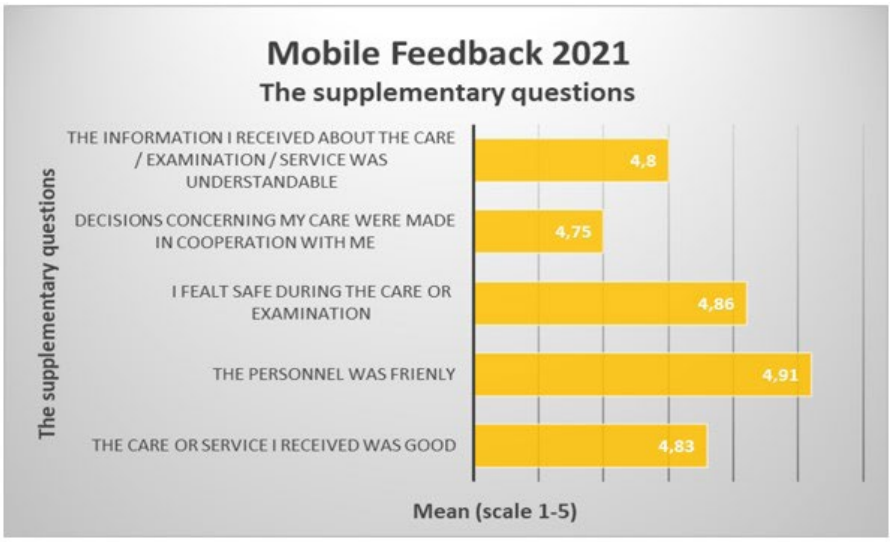


Patient satisfaction and mobile feedback 2021

We have measured patient satisfaction continuously. The patient satisfaction surveys (mobile feedback and feedback form) were open online to all cancer patients treated at TYKS. The main goal is to identify the need for future development. In 2021 the feedback was in line with the mobile feedback (the use of the feedback form was infrequent). During 2021, 1515 cancer patients from the oncology unit have answered. Overall, the cancer patients have provided very positive feedback, the mean satisfaction score has been 9.44 (on a scale from 1 to 10).



The scores provided by cancer patients have always been high. The lowest score was given to supplementary questions related to the item "Decisions concerning my care were made in cooperation with me" mean 4.75 points (on a scale from 1 to 5) and the highest score was given to the item "The personnel was friendly", mean 4,91 points (on a scale from 1 to 5). In addition to the 6 questions, the survey is open for comments. In the report, the comments are sorted by treating unit and topic.



The comments have, in general, been positive, e.g.:

The staff are really friendly and professional. I've had really good treatment. Big thanks.

A bouquet of roses for the doctor. The professionalism and empathy of the doctor boosted my self-confidence, relieved my anxiety and calmed my mind. I will calmly await the next results of research.

A really wonderful and professional nurse at the beginning of cancer treatment, safe and comforting. I got answers to all my questions.

The course of action when the patient has a designated nurse is excellent to me. I called the nurse for an acute concern I had and this was taken seriously. I got medical help immediately, on the same day. I am extremely grateful for the knowledgeable care I have received.

Some comments suggested improvement:

I was waiting for my first visit to the cancer outpatient department. I am alone with the thought of becoming sick with a serious illness. The desire for information is fierce and the waiting time seems really long. If I got some support here, it might be a good thing. Otherwise, I am really happy with the care I get at TYKS.

I had to go to the blood test again because there were flaws in the first referral. It was annoying, but understandable. The doctor did apologize and explained it well.

I would like the doctors to give me more feedback about my situation and the results of treatment. Most of the time I feel safe with the staff and treatments and their behavior.

Standardization of patient pathway guidelines

The Tyks Cancer Centre follows ESMO, ASCO and national recommendations on the treatment of cancer.

To standardize and equalize the treatment in Finland, the national Finnish Cancer Centre (FICAN) has issued recommendations for treatment and follow-up of cancer patients. The first version of these recommendations has now been piloted by two associations for cancer specialists. Current national care recommendations (treatment guidelines) are available at terveysportti.fi intranet, which are limited to health care professionals (Current Care Guidelines). Our plan is to standardize all patient information and treatment instructions of the entire Hospital District of Southwest Finland. In addition, a standardization group for radiotherapy protocols was set up. These harmonized instructions are available for professionals at the proprietary intraweb of FICAN West (FICANintra).

For citizens, several cancer-related treatment instructions are available in the national web page www.terveyskyla.fi and www.terveysportti.fi. The web page www.hoito-ohjeet.fi, also containing information on treatments for patients and the general public, is maintained by FICAN West. The websites maintained by TYKS and www.ficanwest.fi for patients provide the following information:

• all recruiting clinical trials of the Cancer Centre

• updated information on waiting times for referral to the first treatment contact, to surgery, to chemotherapy and to radiotherapy for the most common cancer types

• cancer-specific patient pathways for most cancer illnesses. These pathways include information on the cancer and on how to support and improve patients' understanding on their illness, diagnosis and self-care.

New pathways are being updated continuously.

Standardization of the radiotherapy protocol instructions

In the spring of 2021 it was obvious that the lack of standardized radiotherapy protocols was a burden to many professionals working in radiation treatment in FICAN West. In addition, it seemed like an unsafe policy and an obstacle to equal cancer care that outdated paper file folders were in use in central hospitals. In March 2021, the first initiative was taken to change these radiotherapy protocols to web based, standardized and updated protocols accessible to all radiotherapy specialists.

In June 2021, an important remote meeting was held and the decision was taken that a harmonization project was to be launched by FICAN West, the TYKS administration by and clinicians in TYKS and the Central Hospital of Pori (Satasairaala). In August 2021, the decisions to launch the project was started. The draft of the guideline document is currently circulating and comments are invited. The first areas of focus are treatment of lung, esophagus and gynecological cancers. Co-operation expanded at a meeting in November 2021 when a representative of the Central Hospital of Vaasa joined the group. A technical solution was already available: an intraweb link for professionals working in FICAN West. The next goal is to have the first standardized protocol available in March 2022 in the FICAN intraweb, where it will reside to the benefit our radiotherapy patients and radiation oncologist.

Palliative care standardization of care pathway at whole FICAN West region

The regional team on palliative care has had meetings since 2019 every spring and fall to discuss and develop of palliative care. In the team, there are personnel from TYKS and the central hospitals in Pori (Satasairaala) and Vaasa. The meetings were planned to be held face to face in Pori regularly, but this pattern was changed to telemeetings from the spring of 2020 because of the COVID-19 pandemic.

In the fall of 2019, meetings to harmonize treatment practices were begun with physicians, nurses and rehabilitation specialists experienced in palliative care. Multidisciplinary regional meetings are an excellent form of collaboration, and the meeting practice has harmonized and clarified the treatment principles of palliative care. Meetings have also been considered to be an important mentoring forum. The goal of palliative care is to provide symptomatic relief and maintain quality of care for dying persons when cure or retardation of disease progression is no longer possible. The decision to switch into palliative care is usually made when the patient is in hospital care and when relatives are also present. The treatment principles at the hospitals complies with the ESMO, ASCO and national recommendations on palliative care. For citizens, related treatment instructions are available at www.hoito-ohjeet.fi and www.terveysportti.fi. Importantly, the regional standardization of care pathway is important.

At the meetings of the team developing palliative care, the present state of the palliative care centers have been discussed. The differences of care practices and training have been reviewed and the topics for next meetings decided. The team has observed that the palliative care centers are generally consulted too late or not at all, and awareness of the palliative procedure should be increased. The frame of palliative care is different in hospitals and initiatives to equalize care are important. The themes of the meetings in 2021 were a) Model for a pathway of care (content and documentation technique) and b) Consultation (procedures and challenges). A need to harmonize care guidelines for personnel and education material for patients has been observed. Thus, a guideline-coordinating group was established. The pilot was to publish a joint "Living will" guideline by the three hospitals to be published in hoito-ohjeet.fi. The importance of continuing regional training has been recognized and symposia on palliative care for the personnel and on psychosocial care for the network of cancer nurses were organized. The next steps will be to discuss appropriate documentation and filing practices of patient records and key performance indicators.

Multidisciplinary team (MDT) meetings at the Tyks Cancer Centre and FICAN West

In 2021, there were 20 regular clinical multidisciplinary team (MDT) meetings held in TYKS on different cancer types. 14 of these MDT meetings were weekly by skype. The MDT includes a surgeon, a pathologist, a radiologist, a medical oncologist, a radiotherapy oncologist and nurses from the surgical and oncological departments. Meetings on cancer of the head and neck, lung, brain, female genital tract and gastrointestinal tract cancers involved also a video conference connection with the central hospitals in Pori and Vaasa. The MDT makes recommendations on how the patient is to be treated, and these recommendations are registered in the patient records.

MDT meetings deal with specific tumor types of individual patients. Thus, every patient with breast cancer, colorectal cancer and testis cancer is discussed in an MDT after surgery. Patients suitable for neoadjuvant therapy, e.g., patients with gastric cancer and urothelial cancer, are brought to an MDT to ensure an uninterrupted treatment path for the patient from diagnosis to chemotherapy and surgery. The treatment of brain tumors, head neck cancers and lung cancers demand close collaboration between a radiologist, pathologist, surgeon and radiotherapy oncologist and patients with these tumor types are a natural and recurring topic at MDT meetings. Lymphoma patients who require high-intensity chemotherapy and stem cell transplantation rely on the collaboration between oncologists and hematologists which primarily convene at MDT meetings. Difficult cases and rare tumor types are typically discussed and decided upon at MDT meetings. Patients eligible for ongoing clinical trials are also often identified at MDT meetings.

FICAN West Molecular tumor board (MTB)

In order to facilitate implementation of precision medicine molecular tumor boards (MTB) has been etablished in hospitals. FICAN West molecular tumor board (MTB) has been arranged since 2018. In monthly multidisci¬plinary meeting attended by cancer physicians, pathologists, geneti¬cists, clinical chemists and molecu¬lar biology experts individual cases of cancer patients who have undergone comprehensive large genomic profiling on a cancer sample or blood are discussed in detail. The aim is to obtain more information about the nature of the cancer based on the molecular changes found by genomic profiling, to find the optimal drug to treat the patient and to assess the possible heritability of the genetic change and the need for further studies. By now, more than 100 patient cases have been tested by different large genetic analysis methods and about 35% of the cases have been ad¬dressed in the MTB meetings. In addition, the meeting address a wide range of current issues related to gene-guid-ed cancer treatment to increase the awareness of physicians.

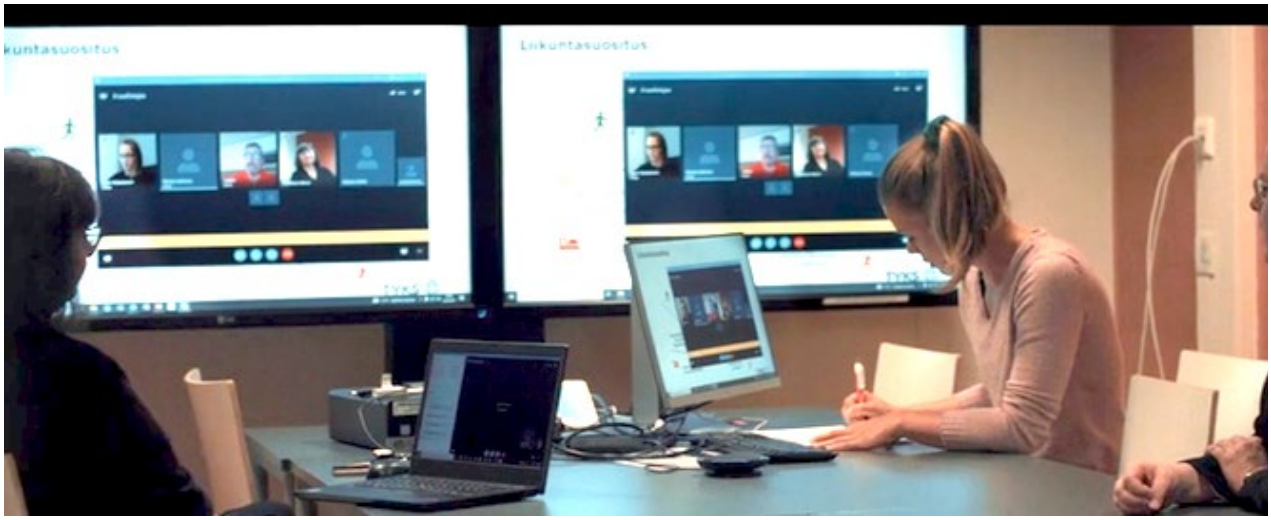
In 2022, two new studies on cancer patients are planned to begin at the Hospital District of Southwest Finland to develop molecular analysis and personalized cancer treatment. The aim of the PROSMO-study is to develop and set up local sampling and genetic analysis of cancer and to screen patients for FINPROVE-study. The aim of the FINPROVE study is to enable gene guided off-label treatment of advanced or metastatic cancer patients when standard treatment obtions no longer exist. FICAN West experience in MTB meeting activity has an important role in both of these studies.

PROSMO-study also aims to enable close research collaboration between clinical research and basic research. This is important for the development of cooperation between Turku University Central Hospital, the University of Turku, Åbo Akademi University and the pharmaceutical industry. Cooperation started to be built in 2021.

In December 2021 Erchner foundation granted 672000 euros funding to carry out PROSMO- and FINPROVE-studies.

https://ficanwest.fi/en/for-professionals/molecular-tumor-board/

Cancer Centre Client Board



The members of the Client Board have had four meetings in 2021 to contribute to the planning of cancer treatments, rehabilitation and research and to benefit the development of activities and support services for cancer patients in TYKS, Satasairaala and the Vaasa Central Hospital. The COVID-19 pandemic has forced us still to postpone face-to-face meetings, and we have turned to virtual hybrid telecommunication. The concrete development topics during 2021 have been:

Begun 2020

- model for cooperation with the family – some of the members have participated in the work of a development group arranged by students in the Master of Health Care degree program in the University of Applied Sciences of Turku

- rehabilitation skills and knowledge test – arranged by students in the Master of Health Care degree program in the University of Applied Sciences of Turku2021 have been:

New 2021

- exercise during and after treatments for male patients. This new initiative for arranging exercise training especially for male patients has led to further collaboration projects with the Southwest Finland Cancer Association, Satakunnan syöpäyhdistys and Pohjanmaan syöpäyhdistys (see page...)

- nutrition of cancer patients - the need for uniform nutrition guidelines for personnel and patient education was highlighted and in 2022 a development project will be launched under the auspices of a multiprofessional group of nutrition experts at TYKS

With the Client Board of the TYKS Main hospital and the TYKS Vakka-Suomi hospital

- principles of good service – what does the client promise of TYKS mean to patients: "We will improve every day"? Discussion sessions for further development at TYKS

Further, the goal is to become a part of the European Care Diseases (ERN /Euracan) Client Board with a national cancer center development project.

Psychosocial and rehabilitation support to cancer patients

Patients prefer it when psychosocial support is easily and naturally available as an integral part of the care pathway. The Psychosocial and rehabilitation support development and scientific program of the Cancer Centre of western Finland is an effort to respond to patients' psychosocial needs and to support cancer patients and their families. In 2021, the draft program was discussed and there was agreement among the development group on implementation of some concrete actions. The final program prepared by professors of the Department of Nursing Science and Psychiatry of the UTU, by multidisciplinary experts on cancer treatment and psychiatry from the TYKS, Satasairaala and Vaasa Central Hospital, by representatives of the Turku University of Applied Sciences and by representatives of the Cancer Associations in western Finland.

The priorities of the program are:

- well-working psycho-oncological services
- methods of support within patient care
- sufficient professional know-how and education
- assessment, development and research

The targets for 2022 are to discuss the present state of support and the degree of interest in implementing concrete actions in all cancer care departments of TYKS. Several development projects have already been initiated and several have been completed in 2021.

Promoting FICAN West clinical and supportive personnel and cancer patient organisations network

Web-based physical exercise sessions for cancer patients in co-operation with cancer society

Turku University Central Hospital (TYKS) Cancer Centre and the Cancer Society of Southwest Finland together endeavored on a project to provide cancer patients exercise guidance by web-based platform. The goal was to encourage cancer patients to pursue physical activity and to exercise in a versatile fashion during and after cancer treatments and to help them get peer support. The purpose was to have cancer patients attain and maintain the level of exercise recommended by international experts by participating through a distance learning platform. The types of exercise were versatile muscle strength training and exercises to maintain and improve mobility, balance and movement control. Endurance training may be well carried out by the participant and no external help is required.

Since the beginning of 2021, low-threshold remote exercise trainings have been carried out online with the use of a web-based application. Professional exercise and rehabilitation instructors and a non-professional peer directed the exercises. Each training event had a duration between 20 and 40 minutes.

The link to open the web-based exercise training was used 421 times during the first six weeks. During these weeks, participant feedback was also invited and collected. Sixty-five participants chose to reply. The feedback form included questions on the experiences of the participants and the replies were set on a Likert scale from 1 to 5, where 1 = fully disagree and 5 = fully agree. Almost all participants felt that the instructors were professional (average points 4.8), that remote exercise training encouraged continued exercise (4.8), that it was a safe way to exercise (4.8) and that participation by remote access was convenient (4.8). The majority agreed that the duration of the training sessions was appropriate (4.7) and that the training provided a feeling of well-being and recreation (4.6). Almost all participants felt that they might well participate in training sessions again (4.8). The spread of the answers was most marked for questions regarding the technical performance of the video connections (4.2) and expectations on the content of the session.

In the fall 2021 a model was designed for how to best organize the web-based training sessions, which subsequently have been organized within the entire region of the FICAN West. Each cancer association in the region takes part in the activities and arranges live instructions. The goal is to integrate the model as a part of the activities of all cancer centers and cancer associations in Finland. Each cancer association organizes and provides group exercise as well.

Information desk of the Cancer Society of Southwest Finland

The information desk of the Cancer Society is situated on the first floor of the TYKS T hospital, in the vicinity of the departments that manage cancer patients. The office provides information on matters like information courses arranged by the Cancer Society of Southwest Finland, the availability of peer support and the availability of medical professionals. The activities are planned in collaboration between the TYKS hospital and experts of the Cancer Society.

The information desk was visited by professionals and volunteers from the Cancer Society of Southwest Finland who were there to respond to questions on rehabilitation in general, on the activities of the Society for young adults and about prostate cancer.

Because of the COVID pandemic, the information desk was closed in the beginning the year. At that time, nobody was available in the information desk, but it we possible for clients and patients to submit applications for reimbursement for days of therapy and to have some information via TV screens and brochures.

As soon as the pandemic situation allows the activity of the information desk will continue as follows:

- The nurse of the Society will be available on Wednesdays from 9 to 12 AM.
- The expert on family work of the Society will be available on Thursdays from 12 to 2 PM. The expert provides information specifically on services directed to families and on activities for adults.
- Volunteers from the volunteer group ETUSET which handles questions related to prostate cancer are available on Tuesdays from 9 to 12 AM.

The Cancer Nursing Network

The network organizes networking events, training sessions and workshops and distributes science-based information electronically. Operations are constantly being developed to respond to the needs of the healthcare staff. Organizationally, the Cancer Nursing Network involves collaboration among three hospitals: the TYKS hospital and the central hospitals of Pori (Satasairaala) and Vaasa. The activities of the cancer treatment working group has become permanent during the recent years.

In 2021, the network has mainly organized training sessions through telecommuting due to the COVID pandemic. During these sessions information has been provided on the scientific basis of information and on best clinical practices. The topics of the training sessions, which cover one afternoon, were psychosocial support and sexuality of cancer patients. The training afternoons were very popular and were attended by 60–90 professionals from tertiary care, the cancer society and primary care. According to the feedback from these afternoon training sessions the sessions corresponded very well to what the expectations were and provided the audience with new information and new ways to look at cancer nursing. The topics of the training sessions were perceived as being important and it was hoped that FICAN West continue organizing similar training.

The network of cancer nursing is active, and a future goal is to organize trainings and other events for the network. The goal is to make the network more visible in our society and to further broaden the network into a larger audience of professionals within primary care.

Network event designed for managers and professionals

FICAN West introduced a new form of activity by organizing a virtual telemeeting for managers and experts in cancer care who The purpose of the event was to support development initiatives and research in the health care units that manage cancer patients. The purpose of the event was to provide information about how experts currently get their training and to give managers an understanding and the readiness to support employees to educate themselves and to pursue research in the units where they work. The network event included four brief presentations on the following topics:

- Differences between the master's thesis at the University of Applied Sciences and a university treatise
- Thesis for the master's degree at the University of Applied Sciences in FICAN West on a family model case
- A thesis for the master's degree at the University of Applied Sciences and the studies involved have benefited the evolution of nursing in FICAN West
- Development projects in the region of the Hospital District of Southwest Finland and supervisor activities – factors that support development and research

There were more than forty attendees interested in the topic at this event and discussion was lively. The feedback showed that the event corresponded well to the expectations and provided the listeners with new information. The participants were eager to have similar training events in the future.

Since then, the goal has been to arrange specific events for managers and experts within the FICAN West region. The topics for future events include development of multiprofessional collaboration, how to respond to the challenges met when implementing new research results and developing collaboration with patients.

Selected highlights in patient care development projects

Digital pathway to support cancer patient information needs

The patients of the TYKS Hospital cancer clinic have since 2019 been offered an electronic service channel, a digital treatment path built on the Health village platform. By using the electronic service channel the patient can contact the hospital personnel and vice versa. The service channel contains information on cancer, rehabilitation, support services and coping with cancer. The nursing personnel may use the electronic service channel for individualizing patient education. The service channel may also be used by the patient for reporting symptoms. An example: the symptoms and well being of patients on immuno-oncological treatments are followed up during treatments through weekly symptom surveys entered into the system by the patient. The patients and the personnel have found the digital service channel easy to use and helpful.
In 2021, the emphasis of developing the service channel was put on better recruitment of patients to use the electronic service channel and to improve the data content of the digital treatment path.

In 2021, systematic recruitment was directed toward breast cancer patients in all breast cancer treatment units and toward other patients in the cancer clinic who are on active cancer treatment and follow-up.

In 2021, two new projects were launched – one for patients with prostate cancer and the other for patients with gut cancer. The goal is to implement the electronic service channel throughout the treatment

path and to unify the contents of the digital treatment paths, especially from the point of view of support efforts and coping with cancer in everyday life.

To improve the information content, a usability survey was distributed and the client board of the cancer center was consulted as to what information the patients expect to get out from the digital treatment path. The answers led to actions to increase the data/information content of the digital treatment path on psychosocial support, support services and family support to patients who have fallen ill with cancer.

In the future, the intention is to safeguard the digital know-how of the personnel and to carry out a pilot study on measuring the patients' quality of life with the help of the service channel. The information content of the digital treatment path is continuously improving so that it corresponds ever better to the patients' needs. In 2022, the goal is to increase the amount of video material in the treatment paths. The use of the electronic service channel is continuously assessed and evaluated, and feedback is collected to improve the quality and information content of the digital treatment path.

Piloting the low-threshold nursereception to increase cancer patient psychosocial support

A pilot of a new type of nurse reception was started at the Cancer Clinic and Palliative Care Center. The aim of the pilot is to provide low-threshold psychosocial support for adults with cancer. Firstly, three cancer clinic nurses received training to have additional competence of psychosocial support. Secondly, the one a week low-threshold psychosocial support reception was build up.

In the reception process, the individual encounter of the patient and the understanding of the changed life situation are essential. The purpose of the reception is to:

- assess the comprehensive mental, social and spiritual situation of the patient and nearbyothers
- support the patient's daily survival
- promote the patient's mental and social survival at different stages of the disease
- provide information and guidance on the right services

The experiences of the pilot have been positive and patients and nursing staff have been satisfied with the new approach. In the future, the goal is to make the reception a permanent part of the care pathway at cancer clinic and palliative care center, and to expand the reception activity model to other units treating cancer patients in TYKS.

Supporting the family of an adult cancer patient

Family members of persons who fall ill with cancer may become anxious and depressed. They are concerned about how the illness may affect family relations, their financial situation and how the perceived responsibility for managing the needs of the family and its economy are affected.

In 2019, FICAN West launched a development project to focus more on the patient's family and family needs. The goal of the project was to improve the wellbeing of the family of the adult cancer patient and to make better use of multiprofessional collaboration and client orientation in the context of cancer patient management. The project was carried out as a thesis project within the Turku University of Applied Sciences.

The project examined the support provided and needed by adult cancer patients and their families during the different stags of the cancer treatment path. The project consisted of a systematic literature review, a survey directed to the client board of FICAN West and multiprofessional expert workshops.

The results show that

- The families' need of support for rehabilitation was not examined by systematical patient inquiries
- Patients perceived that the support they received was mainly directed at themselves, but support was also available for the spouse and children.
- The support consisted of discussions and support, information, adaptation training and peer support.
- The patients considered that the support is important but insufficient.
- There was a need for support at every stage of the treatment path.

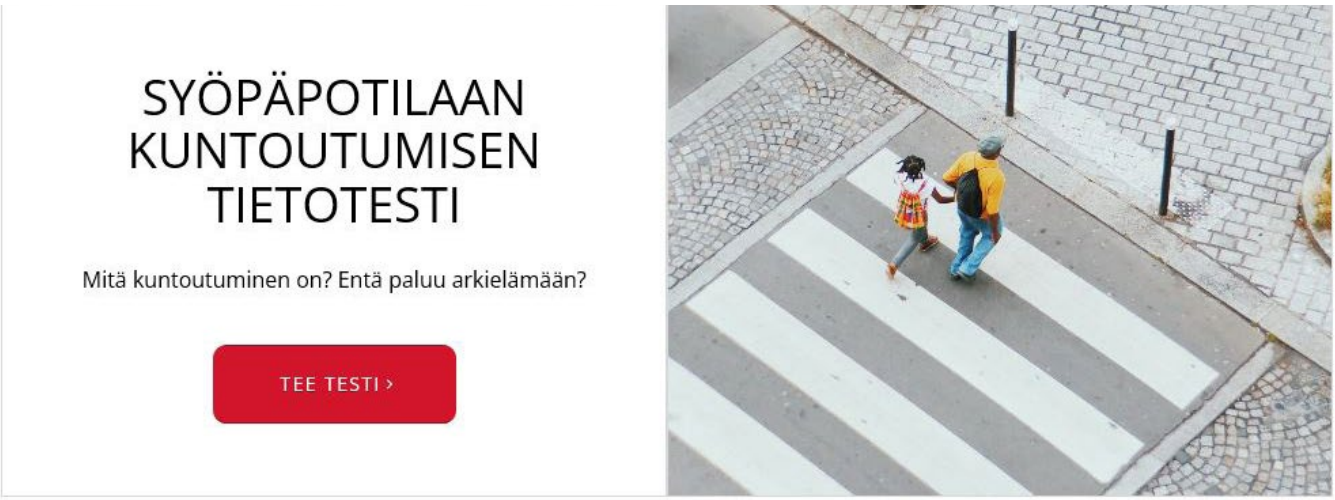
The professionals who cared for the cancer patients experienced that the practices of examining the need for support to the family varied from one hospital unit to another; no systematic practices were followed. There was a perception that examining the need for support was dependent on the health care professional involved in managing the patient; it was mainly the patient's need for support that was examined, not the need of the family. The need for support was examined at all stages of the treatment path. It was felt that the know-how was there but not always the required resources and that patients are unequal as far as obtaining services is concerned.

The development project resulted in the document Family model for units treating cancer patients. The document is, in practice, a checklist that can be used to examine the family's need for support systematically for each patient in the beginning of treatment, in the middle of treatment and in the end of treatment. If needed, the checklist provides guidance to the family for further support services available within tertiary care, primary care or the third sector.

The future goal is to expand the family model to include the entire area of FICAN West, to implement the family model and to make it a part of daily management of cancer patients. We are planning training days for employees caring for cancer patients on the availability of various support services for families.

Cancer patient rehabilitation e-Knowledge test

Patients who have fallen ill with cancer and their families do not always have a clear picture of what kind of rehabilitation support they are entitled to and what they themselves could do to improve their



possibilities to obtain this benefit. Information is fragmentary and not available systematically during treatment. An obvious need was identified for a unified set of information on rehabilitation support, and this need gave clear support for better patient guidance.

As a part of the psychosocial and rehabilitation support development and scientific program of FICAN West, a knowledge test on rehabilitation was generated. The electronic knowledge test was developed in the framework of a thesis for master's degree at the University of Applied Sciences

The purpose of the thesis was to present reliable information on the support alternatives available for rehabilitation of cancer patients and to introduce this information in the form of an electronic knowledge test to support the patients who have fallen ill with cancer and their families during and after the therapies. Increasing the level know-how of professionals in cancer care on rehabilitation was also a desirable goal.

For the thesis, ten members of the client board of FICAN West were interviewed. The results of the interviews were used to set the topics of the knowledge test so that they corresponded to the needs of the patients. The knowledge test included the following topics: physical activity, sexuality, nutrition, socioeconomic support, psychosocial support, biophysical support and rehabilitation.

The e-Knowledge test on patient rehabilitation was constructed with the help of the client board and a multiprofessional expert working group and is available on the web page of FICANM West: https://ficanwest.fi/syopapotilaan-kuntoutumisen-tietotesti/ . The knowledge test benefits cancer patients, their families, the personnel and the entire population by increasing awareness on this subject. In the future, the knowledge test will be used for patient education.

Research

Tyks Cancer Centre and FICAN West Research Cluster

Cancer research at FICAN West encompasses the Hospital District of Southwest Finland (VSSHP) including Turku University Hospital TYKS, and the Central Hospital of Pori (Satasairaala), the Central Hospital of Vaasa and the cancer research at the University of Turku. The aim of FICAN West is to bring together and support basic and clinical cancer research.

Both academic laboratory research as well as investigator-initiated and industry-based clinical trials are run at FICAN West. The FICAN West cancer centre research laboratory is located at Medisiina D building since 2018, and it is dedicated for basic cancer research of 10 research groups and 50 laboratory researchers. In total, FICAN West cancer research network includes about 30 research groups and 150 scientists working full-time in translational and basic research in the campus area. On the hospital side over hundred physicians are dedicated to the treatment of cancer patients and about half of them are actively involved in clinical trials.

The estimated annual research budget in 2021 for Tyks Cancer Centre clinical research was ca. 2.2 mil. €. For translational and basic research, the estimated annual research budget in 2021 was ca. 10.6 mil. €. For translational and basic research, 34 % of the funding was provided by national public organizations and 66 % by national private sources, EU, other international sources and by commercial co-operation organizations. In 2021, altogether more than 200 cancer associated journal publications were produced across clinical divisions and translational and basic research in FICAN West.

Clinical trials are pursued at several hospital divisions in TYKS. The clinical trial division runs studies for the Departments of oncology and radiotherapy, gynecologic oncology and lung cancer as well as urology. The division employs 5 study nurses and 2 study coordinators. The stem cell transplantation unit employs 2 study nurses and department of urology two study nurses and a study coordinator. The clinical trial division has several part-time physicians (medical oncologists) allocated for clinical trials. Several physicians across the departments as well as central hospitals in Pori and Vaasa take part in the trials. Clinical trials that are recruiting are listed on the website (www.ficanwest.fi). Phase I clinical trials have been done in close co-operation with the Clinical Research Services Turku (CRST). The Tyks Cancer Centre is a member of the Nordic Network-for Early Clinical Trials (NECT). We have research collaboration with the Department of Nursing Science at University of Turku which is highly ranked. FICAN West research activity and strategy are discussed in the common boards of the Tyks Cancer Centre and of FICAN West. The Scientific Cancer Board includes senior members from all cancer related TYKS divisions, and Pori and Vaasa Central Hospitals, as well as scientists pursuing cancer research at diverse departments of the University of Turku. The science and research strategy of the Tyks Cancer Centre and FICAN West is described below.

Western Finland Cancer Centre (FICAN West): science and research strategy 2019-2022

The strategy for 2019-2022 is a part of the strategic planning of the future of the entire FICAN West. It is aimed at securing effective and high-quality treatment, research and training in the field of oncology for the population in the region in a center of excellence.

Vision

FICAN West and its Scientific Cancer Board coordinate the cancer research in the FICAN West region and guarantee uninterrupted funding of high-quality cancer research. They secure rapid and effective adaptation of scientific research results into practice and innovations. FICAN West also unifies and develops collaboration in the field of education.

Values

FICAN West operates by the following values:

- Values of the science and research strategy of the Turku University Hospital (TYKS): ethical, critical, patient/client centered and clinically and socially efficient.
- Strategic values of the University of Turku: ethical, critical, creative, open-minded and societal.
- Strategic values of the FICAN West: patient oriented, equal admission to treatment and high-quality care, innovative and capable personnel, high-quality scientific research and comprehensive, innovative and international collaboration networks.

Strategic goals

The strategic goals of the FICAN West Cancer Centre overlap with those of the research activities of the working environment.

1) High-quality scientific research

- supports the strongholds of the working environment: 1) drug development and diagnostics, 2) bioimaging, 3) research into the molecular biology, genetics and immunology of cancer and 4) clinical drug and stem cell trials
- has established functional structures and sufficient material and human resources
- funding is secured and has an established financial strategy which covers the topics and areas needing financing – public financing, foundations, international funding and research collaboration agreements
- has access to vast patient registry data and biobank material
- guaranteed by up-to-date assessment and follow-up of clinical research

2) Improving research effectivity through networking

- functions as the central coordinating unit and integrates cancer research within the FICAN West research environment
- guarantees that research collaboration with the projects undertaken by the Health Campus of Turku functions smoothly and effectively across administrative borders and between universities, faculties and hospital districts
- guarantees that the infrastructure related to cancer research (e.g., Auria Biobank and the Turku Clinical Research Center) functions well
- guarantees smooth cooperation with the functions of the biotechnology business cluster within the region
- takes place with companies only through the FICAN research center (one-stop-shop principle)
- guarantees continuity of research through training, clinical scientists' positions and recruitment

3) Promoting application of new information

- Promotes, within its working environment, the transfer of information on cancer research outcomes from basic research to the clinic by communicating and by arranging joint meetings
- manages the introduction of new procedures and quality assessments in the domains of cancer prevention, diagnostics, treatment and rehabilitation, new drug treatments, new diagnostic methods, psychosocial support and patient instruction
- strengthens the knowhow of the personnel and promotes a research-oriented atmosphere
- guarantees patient involvement and adherence to research and development projects

4) Promoting innovation

- supports collaboration with the Health Campus of Turku and with its innovation ecosystem platforms
- is strengthened by collaboration with companies and relies on the thematic entity of drug development and diagnostics within the University of Turku

5) Making a national and international impact

- on the national level, this is done through collaboration within the entire FICAN (national and regional cancer centers)
- collaboration is pursued with cancer organizations and patient organizations
- acts as a member of the European cancer network OECI (Organization of European Cancer Institutes), the European reference network on rare adult cancers (ERN EURACAN) and the European reference network on pediatric oncology (ERN PAEDCAN)
- extensive activity (e.g., memberships and specialist assignments) within national and international research teams and teams working to improve and develop cancer treatment

6) Promoting assessment of research effectiveness

- the research strategy is assessed as a part of the overriding science and research strategy, center-of-excellence-strategy and accreditation by the OECI

7) Dissemination of research information

- consists of national and international activity and is part of the overriding strategy of the FICAN
- is presented in plain language for stakeholders and interest groups

Key indicators 2021

218
Total number of journal publications produced across divisions and basic research.

30
Number of cancer research groups in basic and translational research

11
Projects funded by EU

30
Number of publications with impact factor (IF) > 10

€ 12.8 million
Estimate of total research budget

4
Projects with other international funding

11
Number or publications with IF> 20

49
Projects with national private funding

13
Published PhDs

166
Number of clinical trials

41
Projects with national public funding

8
Disclosures of invention

Promoting FICAN West Research Network

The environment for pursuing advanced cancer research is excellent. With more than one hundred biotechnology companies, with the first biobank in Finland (Auria), with the nationally leading center of nursing science and with profiling research projects of the Academy of Finland, cancer research is targeted for success.

FICAN West collaboration with Turku Cancer Research Society

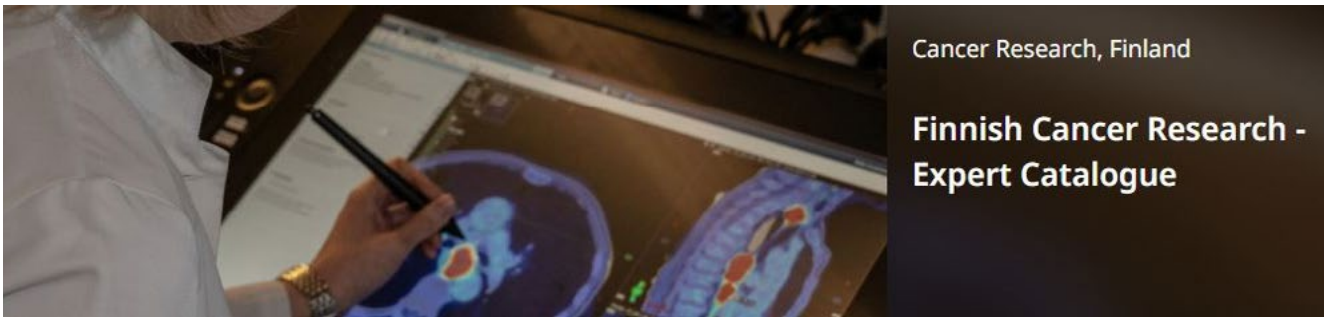
FICAN West has been partnering with Turku Cancer Research Society (TCRS) since 2018 to arrange scientific program for academic and clinical cancer researchers as monthly Cancer Research Seminars Series. COVID-19 pandemic continued throughout the year 2021 and most scientific seminars were organized virtually.

During the year 2021, TCRS and FICAN West jointly arranged altogether 6 monthly seminars, each with one presentation on translational or clinical research and one on basic research. The number of participants was good, ranging between about 40-75 attendees. The Spring Seminar Event "Immuno-oncology and precision medicine" was organized on May 25th 2021 gathering altogether 116 participants together on-line. In this successful event, presentations were given by the head of recently established immune-oncological unit at a local pharma company, and by principal investigators in several Finnish joint research programs, like Cancer IO and InFLAMES, and of clinical studies in precision medicine. The Christmas Seminar Event was arranged as a hybrid event on November 30th 2021 with 65 on-line and about 25 on-site participants. Enlightening presentations dealing with different aspects of cancer drug discovery were given by local experts from Turku University Hospital, University of Turku, CRO Pharmatest Services oy, and by Olli Törmäkangas from Orion who described the whole fascinating development path of a prostate cancer drug darolutamide.

The PhD Thesis of the Year Award was given to Eleonora Mäkelä for her thesis "Novel PP2A biomarkers in cancer". Mäkelä identified new splice variant for CIP2A phosphatase inhibitor (NOCIVA) and found new prognostic and predictive biomarkers for head and neck squamous cell carcinoma and myeloid leukemias. The work has been supervised by professor Jukka Westermarck, Institute of Biomedicine, Turku Bioscience Centre, University of Turku.

The winner of the PhD Thesis Award Eleonora Mäkelä summarized her research findings in the Christmas Seminar in November 2021.

The feedback about Cancer Research Seminar Series has been exclusively positive.



Pilot project: digital match-maker tool to support research collaboration

The pilot project called "Finnish Cancer Research – Expert Catalogue" was launched in August 2021. This is a pilot for browser-based digital match-maker tool directed to medical and research professionals and it is meant to enhance finding new potential collaborators with clinical, basic science or industrial background. The Expert Catalogue aims to collect an interactive record of different professionals associated with cancer research in Finland with their specific selection of expertise in different aspects and backgrounds. The pilot is being implemented in cooperation between FICAN West and Turku Science Park oy.

The pilot trial will run until the summer 2022 and will focus on the area of the FICAN West across different organizations. By the end of 2021, more than fifty professionals involved in cancer research, primarily from Turku University Hospital and University of Turku, have registered. The feedback has been exclusively positive and the need for such a comprehensive list of experts has been recognized. Due to an implemented keyword system, Expert Catalogue can be used as an easy search tool for somebody with a specific expertise. In addition to just browse other registrants, it is possible to send messages through the platform and use the Marketplace-site to advertise specific ideas or requests. The Expert Catalogue is open only through accepted registration.

FICAN West hopes that this tool will facilitate research collaboration widely and increase dialogue between people in different organizations. In order to achieve the best possible benefit, the idea of the Finnish Cancer Research - Expert Catalogue is to cover the widest possible range of different expertise and know-how in Finland. Therefore, the intention is later to expand the listing to cover cancer research professionals across the country.

Finnish Cancer Research – Expert Catalogue web page: https://expert-catalogue.b2match.io/

Opening collaboration with Neurocenter Finland

Neurocenter Finland is a Finnish cooperation network for neurosciences and research. Along with the national cancer centre FICAN and the regional cancer centres including FICAN West, Neurocenter Finland is one of the recently established knowledge centres that are part of the Finnish government's growth strategy to support the health and well-being of Finns through development of research and health technologies.

To initiate collaboration and promote networking between researchers, FICAN West and Neurocenter Finland arranged together a national event Neuro-oncological seminar on March the 16th, 2021. Due to the covid-19 pandemic, the training event was arranged as a webinar. The presentations gave important perspectives to current and emerging brain tumour diagnostics and treatment options from translational and purely clinical point of views. There were altogether over 100 participants from the clinics, academia and pharma industry. The discussion was lively and new collaborations were planned to initiate. Overall, the event was highly appreciated and obviously meeting a need. The webinar was accepted as specializing training for medical doctors at Turku University Hospital (oncology, neurology, neurosurgery) and for PhD studies at Medical Faculty, University of Turku. The collaboration between FICAN West and Neurocenter Finland will continue also in future.

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Neurocenter Finland

Selected highlights in basic and translational research activities

Pluripotency directed cancer fight

Therapy resistance, metastasis, and relapse are the major obstacles to the complete cure of cancer. These properties are believed to be conducted by cancer-associated stem cells (CSCs), which utilize developmental pathways to drive self-renewal and plasticity. The major challenge is that CSCs are extremely hard to detect, separate from adult stem cells and target. Intriguingly, we now understand that embryonic program is activated in CSCs and that human pluripotent stem cells share striking similarities with CSCs.

The special research focus of the Pluripotency & Cancer Laboratory is to understand the activation of the embryonic program in cancer progression. We aim to identify novel biomarkers for CSCs and develop diagnostic tools to detect subtypes of CSCs quantitatively within heterogeneous tumor samples. Our research combines quantitative proteomics, high-resolution sequencing techniques, mass cytometry, and cutting-edge stem cell techniques. The ultimate aim is to boost the development of cancer diagnostics and therapies.

https://narvalab.utu.fi/

Principal Investigator:
Adj. Professor Elisa Närvä, PhD
Docent of Stem Cell Science, Instrumentarium Fellow
Cancer Research Unit, Institute of Biomedicine, University of Turku

Publications:

Närvä E. et al. (2017) A Strong Contractile Actin Fence and Large Adhesions Direct Human Pluripotent Colony Morphology and Adhesion. Stem Cell Reports Jul 11;9(1):67-76.

Närvä E. et al. (2012) RNA Binding Protein L1TD1 Interacts with LIN28 via RNA and Is Required for Human Embryonic Stem Cell Self-renewal and Cancer Cell Proliferation. STEM CELLS Mar;30(3):452-60.

Närvä E. et al. (2010) High-resolution DNA analysis of Human Embryonic Stem Cell lines reveals culture-induced copy number changes and loss of heterozygosity. Nature Biotechnology Apr;28(4):371-7.

High-content screening – phenotype equals function

3D cell culture models essentially aim to recapitulate the complex architecture of solid cancers. In our hands, they are specifically used to study tumour-stroma interactions, epithelial differentiation, and maturation. 3D cultures are also useful to investigate the consequences of failed epithelial differentiation in epithelial cancers: loss of differentiation-related functions often leads to enhanced cell motility and invasion. At our "High Content Screening Lab" or HCSLab, we use advanced 3D models that faithfully replicate the architecture or histology of solid cancer tissues. These models provide the necessary means for predictive in vitro therapy response studies, and personalized medicine. Tissue-like, advanced 3D models also promote the predictive value of early-stage drug discovery studies - for lead discovery and functional drug target validation. For this, we use both cell lines and primary cell cultures extracted from patient biopsies.

In our lab, physiologically relevant, organotypic model systems are coupled with phenotypic 3D screening technologies for basic biomedical and translational cancer research. Critical for cell-based high content screening (HCS) is unlimited access to powerful automated-image analysis software, specialized for the quantitative assessment of the complex multicellular structures of both organoids and stromal components simultaneously. Our imaging pipeline relies on fast and accurate morphometric algorithms, optimised for screening purposes, and provides the means for informed and statistically sound data interpretation. For this purpose, we have developed the AMIDA software package, which can quantitatively measure >50 phenotypic parameters related to the shape, size and texture of organoids. Specifically, we focus on tumour-stoma interactions and aim to assess heterogenic cell populations derived from primary tumour biopsies or patient-derived xenografts.

Our international team consists of two scientists, one PhD student, three undergraduate students and a research technician. Our research is currently focusing on the interplay of FGF receptor and androgen signalling in prostate cancer, and the role of the NOTCH pathway in breast and head and neck cancers. HCSLab is located at the FICAN West Cancer Laboratory facilities and is also affiliated with the Medical University of Lublin in Poland.

Principal investigator:
Adj. Professor Matthias Nees, Ph.D.

https://hcslab.utu.fi/

Publications:

Yu L, et al. (2022). Increased Expression and Altered Cellular Localization of Fibroblast Growth Factor Receptor-Like 1 (FGFRL1) Are Associated with Prostate Cancer Progression. Cancers (Basel) 14(2):278.

Ahonen I, et al. (2017). A high-content image analysis approach for quantitative measurements of chemosensitivity in patient-derived tumor microtissues. Sci. Rep. 7:6600.

Härmä V, et al. (2014). Quantification of dynamic morphological drug responses in 3D organotypic cell cultures by automated image analysis. PLoS One 9:e96426.

From images to information: Machine-learning enabled computational pathology

Microscopy imaging in its various forms is one of the most widely used measurement modalities in biomedical research, creating a rich and versatile source of data also in data-driven cancer research. Especially the availability high-resolution digital images of histological tissue sections, and recent developments in deep learning based artificial intelligence have enabled a breakthrough in computational analysis of histology.

Our "Bioimage informatics" research group works in the forefront of modern machine learning and image analysis, and focuses on data-intensive research questions in cancer research and computational pathology. Our goal is to build computational methods and tools capable of human-level accuracy for cancer diagnostics, grading and subtyping. Further, we seek to expand the limits of histopathological examination beyond visual inspection. Our recent work has focused on developing and artificial intelligence for prostate cancer diagnostics and grading, breast cancer diagnostics, and on developing multimodal artificial intelligence for histopathology.

Currently, digital pathology is rapidly transforming the workflow in routine diagnostics, and our goal is to enable faster, less subjective and in some cases even more accurate diagnostics through computational pathology enabled by modern machine learning. We anticipate that besides enabling decision support for tasks currently done by human experts, computational pathology has the potential for novel discoveries from histopathology beyond the limits of human vision.

Principal investigator:
Assistant Professor Pekka Ruusuvuori, DSc.(Tech)
Institute of Biomedicine, University of Turku & FICAN West.

Funding:
Academy of Finland, ERAPerMed, Cancer Foundation Finland

Publications:

Bulten, W., et al. "Artificial intelligence for diagnosis and Gleason grading of prostate cancer: the PANDA challenge." Nature Medicine 28, 154–163 (2022). https://doi.org/10.1038/s41591-021-01620-2

Liimatainen, K., et al. Virtual reality for 3D histology: multi-scale visualization of organs with interactive feature exploration."BMC Cancer 21.1 (2021): 1-14.

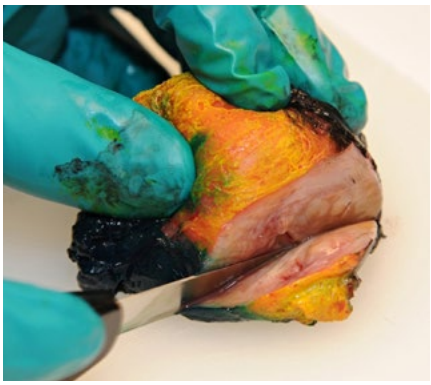
Wang, Y., et al. "Predicting molecular phenotypes from histopathology images: A transcriptome-wide expression–morphology analysis in breast cancer." Cancer Research 81.19 (2021): 5115-5126.

Turku Prostate Cancer Consortium, TPCC

Turku Prostate Cancer Consortium, TPCC, is a research initiative with University of Turku, Turku University Hospital, and Auria Biobank, and the Hospital District of Southwest Finland being the main stakeholders. TPCC brings together academic research groups and clinical professionals of urology and pathology dedicated to research and clinical care of prostate and bladder cancer to innovate and initiate multidisciplinary research projects.

The core function of TPCC is to organize a collection and storage of tissue and liquid samples together with detailed clinical data. The TPCC research technician, in collaboration with the department of pathology and Auria Biobank, collects the samples. Since the introduction of the consortium in 2013, samples from > 1100 RALP (robotic-assisted laparoscopic prostatectomy), and > 150 cystoprostatectomy patients operated in Turku University Hospital have been collected. The samples are available for consortium members who enable and resource the collection. In addition, samples may be provided to external collaborators upon requests. TPCC is administered by the board chaired by MD Peter J. Boström. The TPCC board consists of clinical experts and the PI's of academic research associates.

The multidisciplinary research projects represent various aspects of basic and translational cancer research, from the role of genetic variants, extracellular matrix and hormonal regulation in cancer progression to biotechnological innovations to detect and follow progression on urological cancers. Examples of our current research projects include e.g. biomarkers and exosome research in bladder cancer, gene variant associations to aggressive prostate cancer, in vivo and in vitro modelling of prostate cancer, drug sensitivity screening of patient-derived bladder cancer cell lines, role of extracellular matrix in the progression and spread of cancer, and novel PET/MRI imaging methods in prostate cancer detection and treatment follow-up.



RALP tissues are being processed for diagnostics and TPCC sampling at Auria Biobank.

https://tpcc.utu.fi/

TPCC Board Chair:
Peter J. Boström, MD, PhD
Chief Physician, Department of Urology, Turku University Hospital

Publications:

Kalinen S. et al. Gut microbiota signatures associate with prostate cancer risk. MedRciv preprint https://doi.org/10.1101/2021.08.19.21262274

Islam K. Md, et al. (2021) Detection of bladder cancer with aberrantly fucosylated ITGA3. Anal Biochem, Sep 1;628:114283. doi: 10.1016/j.ab.2021.114283.

Kaikkonen E, et al. (2020) The interactome of the prostate-specific protein Anoctamin 7. Cancer Biomark. 2020;28(1):91-100. doi: 10.3233/CBM-190993.

Selected abstracts of doctoral theses

Novel PP2A biomarkers in cancer

Eleonora Mäkelä, disputation 2021-04-09

Inhibition of tumor suppressor Protein Phosphatase 2A (PP2A) is one of the minimal requirements for malignant transformation of a human cell. In cancer, PP2A activity is in the majority of cases inhibited by the overexpression of the PP2A inhibitor proteins (PAIPs), such as CIP2A, ARPP19, SET, PME-1 and TIPRL. In this thesis, PP2A inhibition by the PAIPs was elaborated in acute and chronic myeloid leukemias (AML and CML) and head and neck squamous cell carcinoma (HNSCC). Moreover, the ability of the PAIPs to act as clinically relevant cancer biomarkers was investigated.

In HNSCC, it would be clinically relevant to identify markers that would predict the radiation resistance of HNSCC tumors. CIP2A was found to be a novel OCT4 target gene, and both of them were found to be involved in HNSCC radioresistance. Analysis of HNSCC tumors for OCT4 or OCT4/CIP2A double positivity at HNSCC diagnosis could be used to predict the radiation resistance.

ARPP19 was identified as a novel predictive relapse biomarker in AML. ARPP19 expression was lower at diagnosis in patients whose disease did not relapse during follow up. Also, we discovered a novel CIP2A splicing variant NOCIVA that could act as a prognostic and predictive biomarker in AML and CML. Elevated NOCIVA expression at diagnosis was identified as a biomarker of inferior overall survival in AML patients. High NOCIVA expression assessed at chronic phase CML diagnosis also associated with adverse event free survival exclusively in imatinib treated patients.

Original Publications:

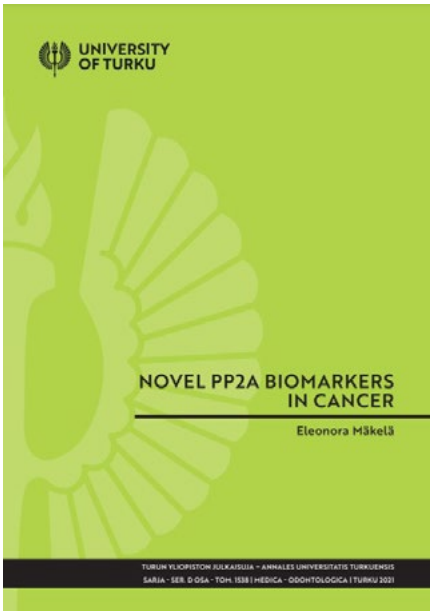
1. Ventelä S, Sittig E, Mannermaa L, Mäkelä J-A, Kulmala J, Löyttyniemi E, Strauss L, Cárpen O, Toppari J, Grénman R, Westermarck J. CIP2A is an OCT4 target gene involved in head and neck squamous cell cancer radioresistance. Oncotarget; 6: 144-58, 2015

2. Mäkelä E, Löyttyniemi E, Salmenniemi U, Kauko O, Varila T, Kairisto V, Itälä-Remes M, Westermarck J. Arpp19 promotes Myc and Cip2a expression and associates with patient relapse in acute myeloid leukemia. Cancers (Basel); 11: 1774, 2019

3. Mäkelä E, Pavic K, Varila T, Salmenniemi U, Löyttyniemi E, Nagelli S, Kähäri V-M, Clark RE, Bachanaboyina VK, Lucas CM, Itälä-Remes M, Westermarck J. Discovery of NOvel CIP2A VAriant (NOCIVA) and its clinical relevance in myeloid leukemias. Clinical Cancer Research 27: 2848-2860, 2021

Supervisor: Professor Jukka Westermarck, Institute of Biomedicine, Turku Bioscience Centre University of Turku, Turku, Finland

Opponent: Professor Kimmo Porkka, Helsinki University Hospital Comprehensive Cancer Center and Hematology Research Unit Helsinki, University of Helsinki, Helsinki, Finland



Cellular vulnerabilities of glioblastoma
Joni Merisaari, disputation 2021-10-15

Glioblastoma (GB) is the most fatal and frequent malignant brain tumor driven by multiple oncogenic pathways. Despite intensive screening of genomic, transcriptomic, metabolic, and post-translational landscape of GB, targeted therapies have provided no improvements for the survival of patients – mainly due to GB´s infiltrative growth, intratumoral heterogeneity and intrinsic resistance towards treatment modalities which are driven by its subpopulations, such as GB stem cells (GSCs). Therefore, it is crucial to try to understand the mechanisms of GBs cellular resistance and potential vulnerabilities of GSCs.

In this thesis, we demonstrated alternative targets for GB therapy. Protein phosphatase 2A (PP2A) is inhibited in GB by non-genetic mechanisms which allows its therapeutic reactivation. Small molecule reactivators of PP2A (SMAPs) seemed efficiently cross the blood-brain barrier (BBB) and exhibit robust cytotoxicity towards heterogenous GB cell lines. Further, specific kinases which inhibition induce synthetic lethality under PP2A reactivation were presented. Collectively, these studies present SMAPs as a novel therapy for GB and propose alternatives for multikinase inhibitors.

Further, we demonstrated an alternative use of nanoparticles in GB. Mesoporous silica nanoparticles (MSNs) functionalized with polyethylenimine (PEI) induced cell death specifically in GSCs. The PEI-MSNs that efficiently crossed the BBB in mice, accumulated in the lysosomes of GSCs and caused lysosomal membrane permeabilization.

Original Publications:

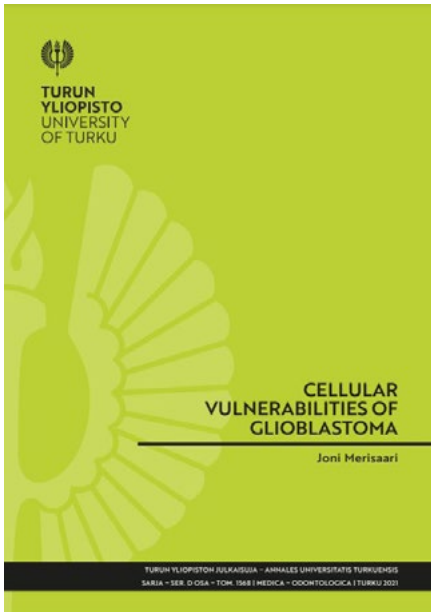
1. Merisaari J, Denisova OV, Doroszko M, Le Joncour V, Johansson P, Leenders WPJ, Kastrinsky DB, Zaware N, Narla G, Laakkonen P, Nelander S, Ohlmeyer M, Westermarck J. Preclinical monotherapy efficacy of blood-brain barrier permeable small molecule activators of tumor suppressor PP2A in glioblastoma. Brain Communications 2, 2020.

2. Prabhakar N*, Merisaari J*, Le Joncour V, Peurla M, Karaman DS, Casals E, Laakkonen P, Westermarck J, Rosenholm JM. Circumventing Drug Treatment? Intrinsic Lethal Effects of Polyethyleneimine (PEI)-Functionalized Nanoparticles on Glioblastoma Cells Cultured in Stem Cell Conditions. Cancers 13:2631, 2021. *Equal contributions

3. Denisova O, Merisaari J, Huhtaniemi R, Qiao X, Yetukuri L, Jumppanen M, Kaur A, Pääkkönen M, von Schantz-Fant C, Ohlmeyer M, Wennerberg K, Kauko O, Koch R, Aittokallio T, Taipale M, and Westermarck J. Triplet kinase-phosphatase targeting to overcome kinase inhibitor in brain tumor cells. BioRxiv doi: 10.1101/2022.01.20.477108

Supervisor: Professor Jukka Westermarck, Institute of Biomedicine, Turku Bioscience Centre University of Turku, Turku, Finland

Opponent: Professor Tapio Visakorpi, Faculty of Medicine and Health Technology Tampere University, Tampere, Finland



Novel imaging and image-guided therapy of prostate cancer

Mikael Anttinen, disputation 2021-08-27

Image-guided ablation of prostate cancer (PCa) has gained acceptance through improved disease characterization by magnetic resonance imaging (MRI) and prostate-specific membrane antigen positron emission tomography-computed tomography (PSMA PET-CT). Novel MRI-guided transurethral ultrasound ablation (TULSA) eradicates prostate tissue under real-time MRI control. TULSA may provide a safe and effective treatment option for a variety of PCa conditions. PSMA PET-CT and MRI may refine PCa diagnosis and improve the planning and response assessment of TULSA treatment.

In the first part of the thesis the applicability of TULSA to focal therapy of primary PCa, palliative therapy of symptomatic locally advanced PCa, and treatment of locally radiorecurrent PCa was investigated in a prospective phase 1 setting. TULSA was shown to be a safe and effective method for local PCa control. Furthermore, TULSA achieved local symptom relief in palliative care and encouraging preliminary oncological control in salvage care. In the second part of the thesis the diagnostic accuracy of MRI and PSMA PET-CT was studied to determine the extent of primary PCa, to plan TULSA treatment and evaluate treatment response. PSMA PET-CT was found to be a more sensitive method for detecting metastatic disease and appeared to accurately reflect the extent of local disease before and after TULSA treatment. These studies have shown PSMA PET-CT to be effective in PCa diagnosis and TULSA to be effective in PCa therapy.

Original Publications:

1. Anttinen M, Mäkelä P, Suomi V, Kiviniemi A, Saunavaara J, Sainio T, Horte A, Eklund L, Taimen P, Blanco Sequeiros R, and Boström PJ. Feasibility of MRI-guided transurethral ultrasound for lesion-targeted ablation of prostate cancer. Scandinavian Journal of Urology, 2019; 5: 295-302.

2. Anttinen M, Yli-Pietilä E, Suomi V, Mäkelä P, Sainio T, Saunavaara J, Eklund L, Blanco Sequeiros R, Taimen P, and Boström PJ. Histopathological evaluation of prostate specimens after thermal ablation may be confounded by the presence of thermally-fixed cells. International Journal of Hyperthermia, 2019; 1: 914-924.

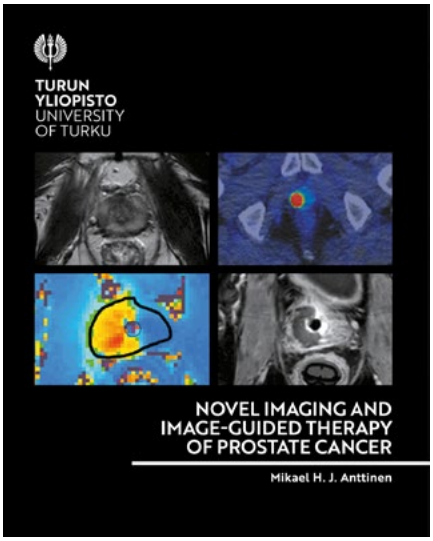
3. Anttinen M, Mäkelä P, Nurminen P, Yli-Pietilä E, Suomi V, Sainio T, Saunavaara J, Taimen P, Blanco Sequeiros R, and Boström PJ. Palliative MRI-guided transurethral ultrasound ablation for symptomatic locally advanced prostate cancer. Scandinavian Journal of Urology, 2020; 8: 1-6.

4. Anttinen M, Mäkelä P, Viitala A, Yli-Pietilä E, Suomi V, Sainio T, Saunavaara J, Blanco Sequeiros R, Taimen P, and Boström PJ. Early experience of MRI-guided transurethral ultrasound ablation for radiorecurrent prostate cancer. European Urology Open Science, 2020

5. Anttinen M, Ettala O, Malaspina S, Jambor I, Sandell M, Kajander S, Rinta-Kiikka I, Schildt J, Saukko E, Rautio P, Timonen KL, Matikainen T, Noponen T, Saunavaara J, Löyttyniemi E, Taimen P, Kemppainen J, Dean PB, Blanco Sequeiros R, Aronen HJ, Seppänen M, and Boström PJ. A Prospective Comparison of 18F-prostate-specific Membrane Antigen-1007 Positron Emission Tomography Computed Tomography, Whole-body 1.5 T Magnetic Resonance Imaging with Diffusion-weighted Imaging, and Single-photon Emission Computed Tomography/Computed Tomography with Traditional Imaging in Primary Distant Metastasis Staging of Prostate Cancer (PROSTAGE). European Urology Oncology, 2020.

Custos: Professor, Matti Laato, Department of Urology, Turku University Hospital, Turku, Finland

Opponent: Professor, Hashim U. Ahmed, Imperial Prostate Division of Surgery, Department of Surgery and Cancer Faculty of Medicine, Imperial College London London, UK



Characterization of gamma-secretase mediated cleavage of receptor tyrosine kinases

Johannes Merilahti, disputation 2021-09-10

Receptor tyrosine kinases (RTK) are a family of cell surface receptors regulating intracellular signaling pathways that control fundamental cellular processes including differentiation, proliferation, and survival. In human cancers, aberrant RTK signaling is a common feature. Gamma-secretase-mediated cleavage of RTKs is a proteolytic cleavage of RTKs in two sequential events: a sheddase-mediated ectodomain shedding followed by the release of a soluble intracellular domain by a gamma-secretase cleavage.

The aim of the thesis was to characterize the gamma-secretase-mediated cleavage of RTKs, with a focus on identifying the prevalence of cleavage among RTKs and developing novel systems biology-based analysis methods to identify signaling associated with the process. The results indicate that half of RTKs are subjected to gamma-secretase cleavage and 12 new gamma-secretase targets were identified. Many of the identified gamma-secretase targets, such as AXL and TYRO3, presented cleavage-dependent effects on cell growth. My research also demonstrated that full-length TYRO3 and soluble intracellular domain of TYRO3 manifest differential signaling.

Together, these findings represent for a first time an approach to determine the prevalence of gamma-secretase cleavage among RTKs. Moreover, this study presents novel methods for identifying still largely unknown RTK cleavage associated signaling. The results of this thesis can provide new insights into the regulation of RTK functions and can be used to develop new strategies for treating cancers.

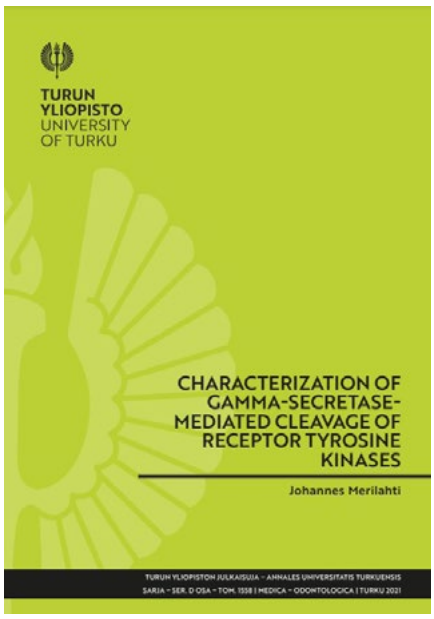
List of publications:

1. Merilahti JAM, Ojala VK, Knittle AM, Pulliainen AT, Elenius K. Genome-wide screen of gamma-secretase–mediated intramembrane cleavage of receptor tyrosine kinases. Molecular Biology of the Cell, 2017; 22: 3123-3131.

2. Merilahti JAM*, Vaparanta K*, Ojala VK, Elenius K. Unbiased multi-omics inference of TYRO3 signaling pathways. Manuscript, 2021.
* These authors contributed equally.

Supervisor: Professor Klaus Elenius, Institute of Biomedicine and Medicity Research Laboratories, University of Turku, Turku, Finland, and Turku Bioscience, University of Turku and Åbo Akademi, Turku, Finland

Opponent: Professori Kaisa Lehti, Faculty of Natural Sciences, Norwegian University of Science and Technology, Trondheim, Norway



Selected highlights in clinical research activities

Clinical cancer trial unit at Turku University Hospital

The activity of the clinical cancer trial unit (FICAN West CTU) at TYKS continued to increase despite of the Covid-19 pandemic. Over 20 new trials were started and recruitment of new patients proceeded as expected. In 2021 the clinical trial unit had 63 open trials of which 53 were drug trials. Of more than 60 trials, 36 were sponsored commercial trials and the rest were academic researcher initiated trials. 32 trials were actively recruiting patients and the rest of them were in the follow-up phase. The first in-house early phase / phase 1 trials were initiated in 2021.

The clinical trial unit has eight full-time employees; two study coordinators, four study nurses, one trial dedicated investigator and approximately 10 part-time PIs and other investigators. All personnel were funded by the income from sponsored clinical trials. The estimated turnover, excluding drugs, was over one million euros. There have been remarkable savings in cancer drug costs for the hospital. Just the immuno-oncological drugs given in clinical trials during 2017-2020 have been estimated to save costs for 1.5 million euros.

Director of FICAN West CTU:
Prof. Panu Jaakkola, MD, PhD

Turku Urology Research Unit

The Urology research team has long-standing track-record of clinical, translational and basic research especially within uro-oncology focusing especially on prostate and bladder cancer. The team has significant research activity on both pharma-sponsored and academic trials. Dr. Boström is the PI in several national prospective randomized trials.

Within the field of prostate cancer, the clinical research has lately focused on medical imaging, e.g. the use of MRI in the detection of prostate cancer and the use of PSMA-PET in primary staging of high-risk prostate cancer.

Next to the clinical studies, the urology research team is running multiple translational and basic science projects. The basis for these studies is the high-volume University clinical unit, which is responsible for the entire prostate cancer diagnosis and treatment in the south-west Finland and it serves as a tertiary care referral center for the west-coast of Finland. The prostate cancer surgeries have been carried out with robotic surgery since 2010.

The Urology clinical research team consists of academic urologists, clinical and translational research coordinators and research nurses. The team is supported by a data manager/biostatistician.

Principal investigator:
Peter Boström, MD, PhD, chief physician

Clinical Hematology Research Unit

Clinical hematology research group is committed to performing innovative research in hematological diseases, including hematological cancers like acute and chronic leukemias and multiple myeloma. Our research group also conducts clinical trials in patients receiving allogeneic stem cell transplantations. We participate actively both in international and national patient-oriented research, including interventional clinical trials. The immediate aim is to constantly develop treatments and apply new findings to the treatment of our patients. Participation in clinical trials also ensures that our patients are able to receive the most advanced forms of hematological treatment.

Our research group comprises of physicians, all of whom carry out research projects and trials along with the routine clinical work. In 2021 four of our physicians were acting as principal investigators at TYKS or as national coordinator in Finland. Furthermore, four physicians acted as sub-investigators. In addition, our research group consist of two full-time study nurses and a part-time research coordinator. External funding, mainly by the income of sponsored clinical trials employs one of the study nurses and a research coordinator.
In 2021, we had 10 clinical trials ongoing. Clinical trials with sponsored study drugs bring remarkable cost-savings to the hospital. The hematology research group is located in the T-hospital. Our stem cell transplantation unit, a part of the Western Cancer Centre (FICAN West), has been nominated as a Centre of Excellence in the Hospital District of Southwest Finland since 2019. This is a proof of our high-level research as one of the leading criteria for granting the Centre of Excellence status is active and qualified research work.

One of the most exciting and revolutionary new clinical trials in coming year will be CAR-T cell therapy. Using this revolutionary new treatment option, we will be able to treat certain blood cancers in patients who have not responded to other treatments. Especially, in patients with B-cell non-Hodgin lymphoma and multiple myeloma, the CAR-T –therapy has led to unprecedented results. The treatment involves removing immune cells from the patient's blood and then genetically engineering them in a laboratory to improve their ability to recognize malignant cells. Then the modified T-cells will be reinfused into the patient. The CAR-T –treatment is a whole new form of adoptive cancer therapy, which provides patients with a new and effective treatment option.

In 2021 we prepared launching a clinical trial regarding CAR-T treatment in newly diagnosed patients with multiple myeloma. CAR-T construct in this trial is called Ciltacabtagene Autoleucel, which is an anti-BCMA directed product. CAR-T –therapy, in this trial, is compared to standard forms of myeloma treatment with maintenance therapy.

Head of the research group:
Professor Maija Itälä-Remes, MD, Chief Physician and Head of Hematology section

Health and quality of life in patients with early age onset cancer

There are several ongoing projects in the department of paediatric and adolescent haematology/oncology which aim at recognising and alleviating the adverse effects of cancer and its treatment.

Milli-C (Microbiota and later life of childhood cancer patients) is still recruiting, and evaluates the association between immune reconstitution and metabolic adverse effects (e.g., obesity) and changes in the gut microbiota.

PACCS/Fysakt (Physical activity in childhood cancer survivors) is an international study on physical activity (PA) after childhood cancer where we are at the moment performing a feasibility study related to PA-intervention.

PACS (Pregnancy associated cancer and survival) is a Nordic study on the short-term and long-term consequences of pregnancy-associated cancer in women and their offspring. The study is run in collaboration with scientists from Denmark, Sweden and Norway.

A local project, called Digital tools in detecting late effects in adult childhood cancer survivors (LERACA), has started in 2018 at our late-effects clinic, and first two publications based on the use of datalakes have been finalized. One of these publications is describing the possibilites of using text-mining in prediction of need for psychosocial support at the end of cancer treatment.

A Nordic project on the late effects of high-risk acute lymphoblastic leukaemia survivors, the HALLON-study, has been launched and will start recruitment in 2022 together with an other late-effect study (ALLStar) that examines low and intermediate risk ALL-patients. Project leaders for high-risk study are professor Arja Harila-Saari from Uppsala University and Päivi Lähteenmäki from University of Turku.

A new project starting in 2022 will be on the genetics of cancer predisposition and drugs used in cancer treatments as well as on ethics of germline testing in childhood cancer patients. Principal investigator for this project will be MD, PhD Laura Korhonen.

Studies on immunopsupression, vaccinations and infections in childhood cancer patients are led by MD, PhD Linnea Schuez-Havupalo.

Palliative care is also one main topic of our research group, and here the principal investigator is Md, PhD Marika Grönroos.
Dr Lähteenmäki, Adjunct Professor, is the principal investigator of a Nordic study on the epidemiology, biology, treatment and survival of children with cancer and severe haematological diseases (NOPHO-CARE). This study is funded by the Swedish Childhood Cancer Foundation.

http://www.vsshp.fi/fi/toimipaikat/tyks/to8/to8c/step

Senior scientist:

Päivi Lähteenmäki,
Adjunct professor, MD, PhD

Project leaders:

Anu Huurre, MD, PhD;
Liisa Järvelä, MD, PhD;
Marika Grönroos, MD, PhD,
Laura Korhonen, MD, PhD,
Linnea Schuez-Havupalo, MD, PhD

Clinical Research Activities at Vaasa Cancer Clinic

The Vaasa Cancer Clinic at Vaasa Central Hospital in the region FICAN West is the largest active cancer unit among central hospitals in the whole Finland. We have about 3,500 patients annually receiving active treatment at our department, of which 1,000 patients receive radiotherapy. Our clinical research unit was established in 2012 and has been actively involved in clinical research ever since. We have currently a capacity to accomplish 6-8 active clinical trials at the same time. Our research functions mainly through GCP-trained physicians and clinical trial nurses.

In addition to clinical drug development trials, we have initiated a clinic wide project to improve existing cancer treatments. Our target is to develop better care including implementing new diagnostics and treatments for clinical practice, but also smoothen existing treatment processes. We are part of various studies using gene-targeted/driven therapies. We have experience in improving surveillance protocols and methods for patients undergoing active cancer treatment and of those who have had successful completion of treatment.

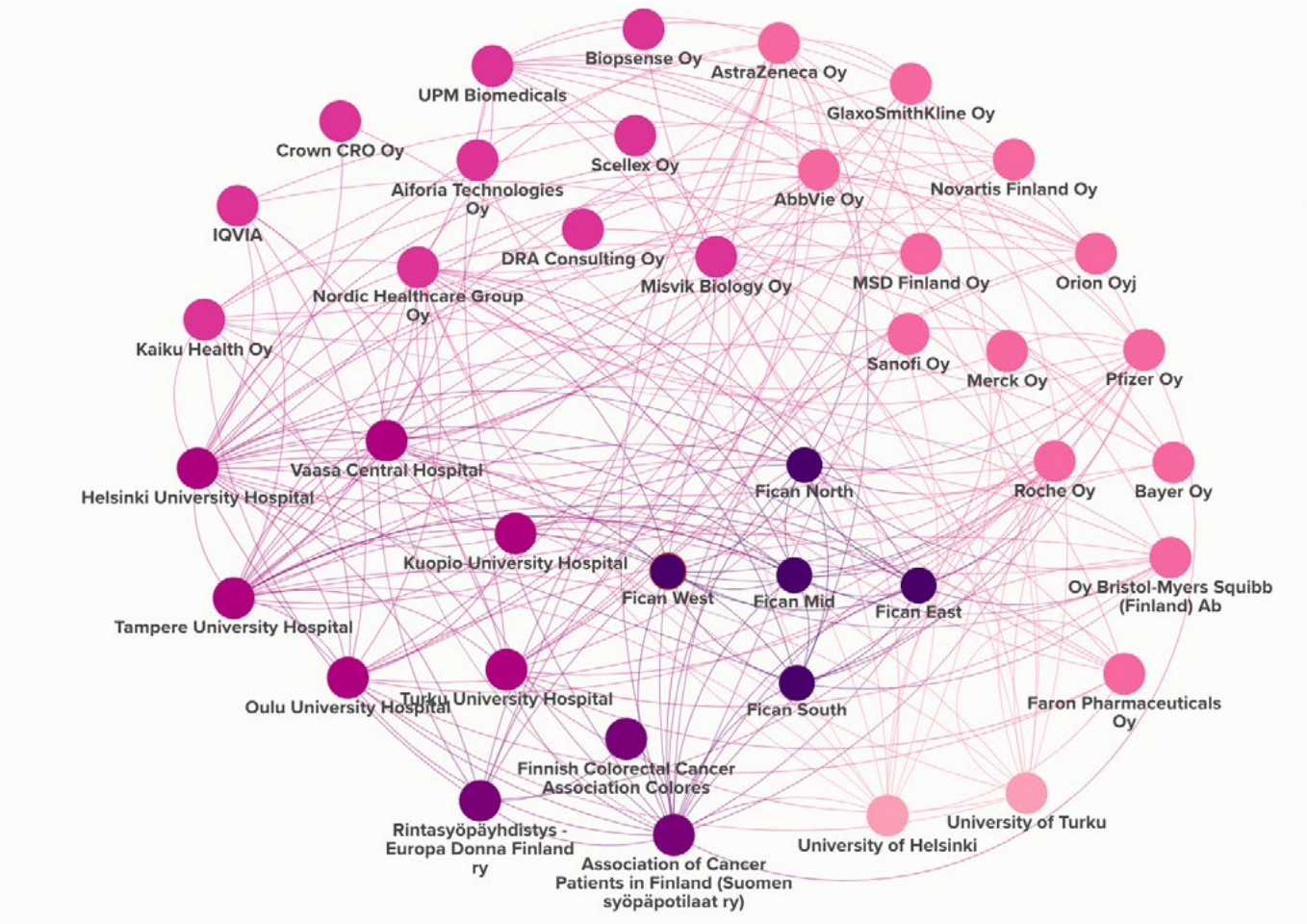
As our clinic is compact and dynamic, we are quick to explore pilot treatment processes and initiate research projects. We at the Vaasa Cancer Clinic were first in Finland to start selecting patients based on DPD enzyme defects before initiating fluoronucleoside-based treatments in both adjuvant and metastatic settings. We believe on openness and thus currently we write around ten scientific reports about our research annually. Now we are extending our activity towards own research protocols, e.g. stereotactic radiotherapy for treatment of oligometastases. The Vaasa Clinical Cancer Research Unit is also popular among students at University of Umeå for their diploma works. These ongoing projects include treatment results in melanoma, lung, breast cancers and involvement of socioeconomic factors in treatment decision making.

Principal Investigator:
Professor, Chief Physician Antti Jekunen, MD, PhD

Clinical Cancer Research Activities at Satasairaala

The clinical research group of the Cancer Unit at Satakunta Central Hospital (Satasairaala) in Pori is involved in drug treatment studies of breast cancer, colon cancer and GIST tumors. In addition, we are participating in national real world-type studies investigating the efficacy of the diagnosis and treatment of bladder cancer and kidney cancer.

Principal Investigator:
Adj. professor Kalevi Pulkkanen, Chief of Oncology, MD, PhD



FICAN West collaborates with Cancer IO research and innovation project

Cancer IO is a cancer immunotherapy focused collaborative research and innovation project that is a part of the Business Finland's Personalized Health Program. The Helsinki University coordinated project integrates immuno-oncology (IO) activities at the Universities of Helsinki and Turku, Turku University Hospital and three other university hospitals, Vaasa central hospital, Finnish small or medium enterprises, cancer patient organizations and the IO-investing pharmaceutical companies. Cancer IO collaborates with all FICAN Cancer Cencers.

Cancer IO looks at immunotherapies from 360 degree perspective: three core themes focus on Society, Research and Health Care. FICAN West is involved in e.g. Cancer IO's RWD project and in preparation of Cancer IO's reports. The latest report, Cancer Clinical Trials – Preparedness in Finnish Hospitals was published in September 2021, and included Cancer IO's recommendations to increase clinical trial activity in Finland. Cancer IO's academic research is conducted in Klefström and Mustjoki laboratories at University of Helsinki and in Hollmén laboratory at the University of Turku, FICAN West.

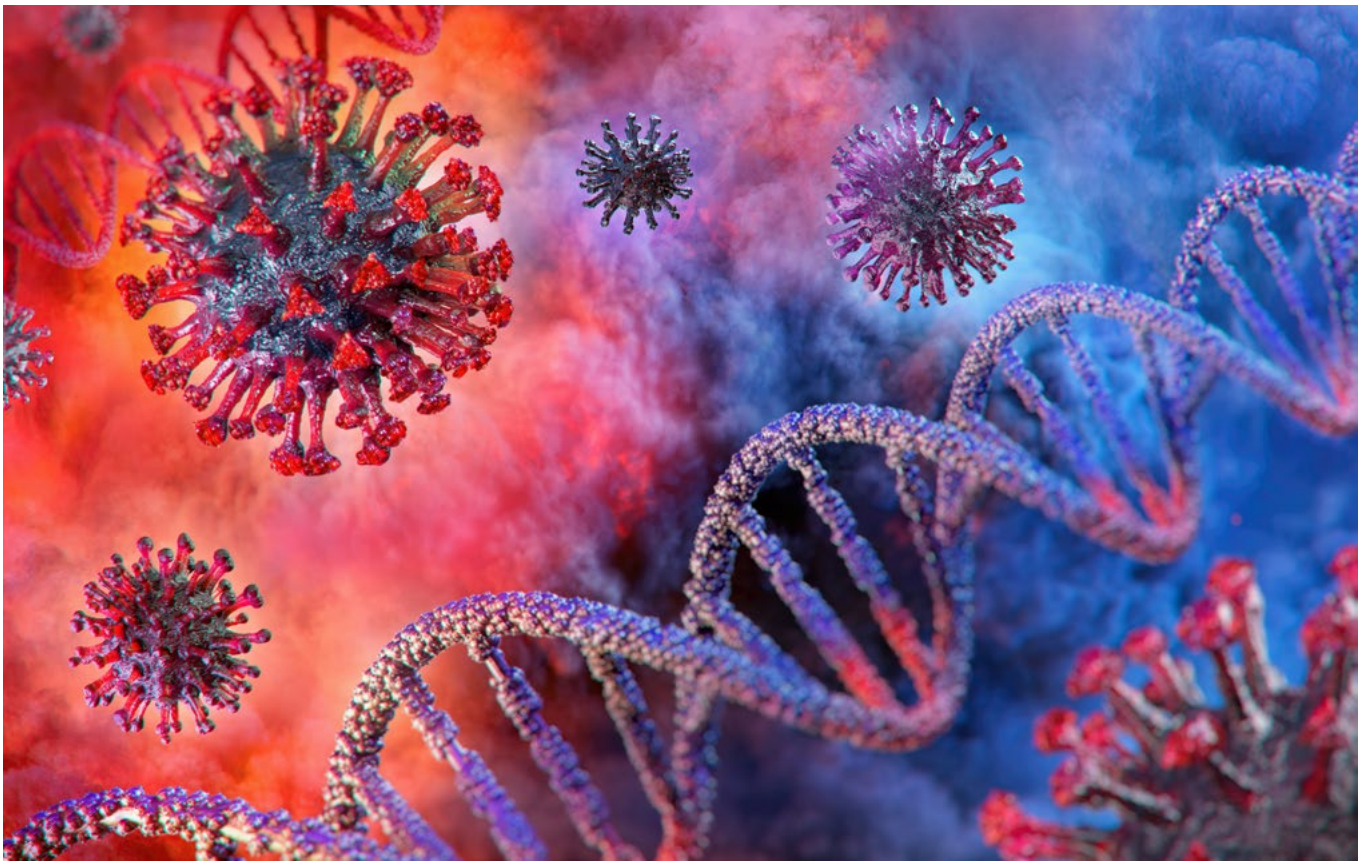
The Cancer IO ecosystem, bringing together more than 30 key organisations in the Finnish IO field, enables extensive collaboration between hospitals, research organizations, companies, and patient organizations, improving patient care, increasing the visibility of Finnish innovations, and contributing to the implementation of the Health Sector's Growth Strategy.

Cancer IO Director:
FICAN Research Professor Juha Klefström

www.cancerio.org

https://cancerio.org/en/cancer-clinical-trials-preparedness-in-finnish-hospitals/)
https://cancerio.org/en/ecosystem/

Cancer IO
Translating Immuno-Oncology into Health Actions



Doc Pia Vihinen, Principal investigator.

Impact of COVID-19 infections on cancer patients: prospective, observational multicenter study

Covid epidemic escalated in Finland during the spring 2020 and the incidence has remained high in December 2021-January 2022. The preliminary statistics from the Finnish Cancer Registry indicate that the amount of cancer diagnoses has decreased during the years 2019-2020. The reason for this is unclear, but it is likely due to that patients have put off doctor's appointments and cancer screening appointments since being afraid of increased risk for COVID infection during visits. The impact of the COVID epidemic, and of the COVID infections on the quality of life and survival of cancer patients are to be assessed.

The current study was carried out in all regional FICAN Cancer Centres. Altogether 323 patients were recruited to this study. Most of the patients had breast cancer. The aim of this study is to evaluate whether COVID infection, asymptomatic or symptomatic, affects the cancer treatments given to patients, the treatment-related toxicity and the quality of life or survival, as compared to patients without COVID infection. In addition, the association of serum inflammation proteins to cancer stage and other clinical prognostic factors and to treatment efficacy will be studied.

Principal investigator in FICAN West: Doc Pia Vihinen.

Other principal investigators in Finland: Professor Sirpa Leppä and Doc Peeter Karihtala.

Physics research in radiotherapy

Adj. Professor Jani Keyriläinen, PhD, Department of Medical Physics, Turku University Hospital

Four physics projects are based on a collaboration between local collaborators, national and international hospitals and institutes, national radiation safety authority, and manufacturers. One of the main objectives is to produce postgraduate degrees for the physics students, in particular for those targeting a vocational certified degree in medical physics. Currently, there are six physics postgraduate students working in the projects described in the following sections.

Dosimetry and dose calculation in radiotherapy

The capacity of radiation therapy (RT) is based on the dose response of cells, which describes the response of the biological object for the ionizing radiation. The dose response is characteristic for different types of cells, and the difference between the response of tumor cells and the response of normal cells is the base from which all the doses for clinical treatment are chosen. The clinical requirements on dose accuracy are based on evidence from dose response curves for tumor control probability (TCP) and for normal tissue complication probability (NTCP). The steepness of the given TCP or NTCP curve versus dose defines the change in response expected for a given change in delivered dose. Thus, uncertainties in delivered dose translate into either reductions in TCP from the optimized expected value or increases in NTCP from the optimized expected value, both of which worsen the clinical outcome.

Treatment with ionizing radiation using small photon fields has been an established practice in stereotactic RT for many years. At the same time, there has been an increasing availability of novel treatment units specifically designed for intensity-modulated RT or volumetric-modulated arc therapy treatments. These technical improvements implicitly encourage the use of small treatment field sizes on equipment originally designed and commissioned for treatments based on traditional, broad photon fields. An experimental determination of small field dosimetric data is challenging and the use of radiotherapy planning (RTP) systems and treatment units not designed nor commissioned for small fields can introduce significant errors in the delivery of treatments.

This project is designed to investigate and understand the physics and challenges behind the small photon fields in terms of measurement, calibration and calculation. The most suitable equipment, detector systems and methods for the determination of dosimetric parameters as well as quality assurance aspects relevant to the use of narrow collimated fields are reviewed. The overall objective is to improve the accuracy of RT for cancer patients. The factors that influence the accuracy of measurement and determination of absorbed dose distribution in a tissue equivalent phantom and the calculation accuracy of RTP system in the particular case of small and composite fields are studied. Topics are carefully conducted with extensive measurements by several types of radiation detectors and subsequently compared to the most accurate Monte Carlo simulations. The project is run by the physicists working at Tampere and Turku University Hospitals and at the Radiation & Nuclear Safety Authority (Helsinki, Finland).

Publications:

Saikkonen A, Ojala J, Keyriläinen J. Analytical Anisotropic Algorithm calculation in total body irradiation: a comparison with Monte Carlo calculation and dosimetry. J Cancer Sci Clin Ther. 5:532-547, 2021.

Niemelä J, Partanen M, Ojala J, Kapanen M, Keyriläinen J. Dose-area product ratio in external small-beam radiotherapy: beam shape, size and energy dependencies in clinical photon beams. Biomed Phys Eng Express. 7:035019, 2021.

Partanen M, Niemelä J, Ojala J, Keyriläinen J, Kapanen M. Properties of IBA Razor Nano Chamber in small-field radiation therapy using 6 MV FF, 6 MV FFF, and 10 MV FFF photon beams. Acta Oncol. 60:1419-1424, 2021.

MRI-only in radiotherapy planning

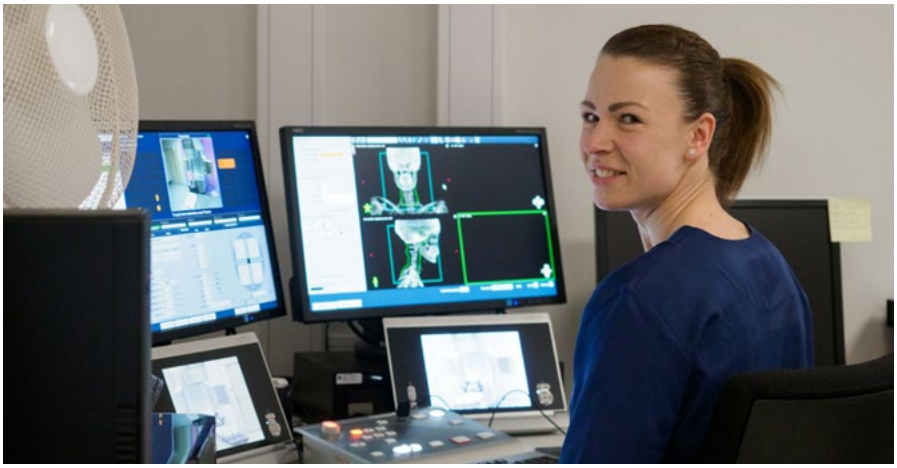
Superior soft-tissue contrast obtainable in magnetic resonance imaging (MRI) compared with other clinical imaging methods enables more accurate definition and delineation of treatment target and organs at risk (OAR) volumes. Also, monitoring of treatment outcome and evaluation of treatment response can be accurate using MR images.

Current practice in the use of MR images for RTP is based on the co-registration of computed tomography (CT) and MR images. This enables the utilization of additional anatomical details provided by MRI, although the dose calculation is based on electron density information available by CT. The use of two different imaging modalities, however, requires additional work and raises costs. Moreover, the error associated with co-registration increases the uncertainty in treatment accuracy. For the aforementioned reasons, it would be ideal to create a practice which is based on a single imaging modality only.

The overall objective of this project is to improve the accuracy of target and OAR definition. The specific aim is to examine the effect of MRI's geometric distortion to dose calculation accuracy in MRI-only-based RTP. Significant distortions in MRI are possible, especially when larger field-of-views are used. A particular branch of examination is the magnitude of geometric distortions produced during diffusion-weighted MRI (DW-MRI). In rapid imaging sequences the gradient magnetic fields required in image encoding produce local eddy currents that cause permanent distortions to both geometry and image intensity. This complicates the definition of treatment volume, hence reducing the usability of DW-based imaging techniques for MRI-only RTP.

In the project, the possibilities of using the MRI for dose calculation are studied in pelvic, brain and head and neck cancers that could diminish the need for CT. On MR images, the tumor and other structures can be differentiated better than on CT images, but they do not contain the electron density information required for dose calculation. The MRI scanner located at the RT department of Turku University Hospital is equipped with a software, which is capable of producing so-called synthetic CT images based on MR image information. These images can be utilized directly in a clinical RTP system. This project is conducted by a close co-operation with other hospitals and the MRI manufacturer Philips Oy (Vantaa, Finland).

In addition to reduced radiation exposure for the patients due to the use of non-ionizing radiation, the methods reduce the number of hospital visits for patients and amount of work for the personnel. This may cause significant savings in time and costs. Clinical advantage for patients is the result of the improved target and OAR definition. In the long term, this may manifest itself as a reduction of complications caused by increased tumor control probability. Determining this would, however, require a large clinical material and a long follow-up period.



Publications:

Keyriläinen J, Sjöblom O, Turnbull-Smith S, Hovirinta T, Minn H. Clinical experience and cost evaluation of magnetic resonance imaging -only workflow in radiation therapy planning of prostate cancer. Phys Imag Radiat Oncol. 19:66-71, 2021.

Yu V, Keyriläinen J, Suilamo S, Beslimane I, Dresner A, Halkola A, Van der Heide UA, Tyagi N. A multi-institutional analysis of a general pelvis continuous Hounsfield unit synthetic CT software for radiotherapy. J Appl Clin Med Phys. 22:207-215, 2021.

Ranta I, Teuho J, Linden J, Klén R, Teräs M, Kapanen M, Keyriläinen J. Assessment of MRI-based attenuation correction for MRI-only radiotherapy treatment planning of the brain. Diagnostics. 10:299, 2020.

Kuisma A, Ranta I, Keyriläinen J, Suilamo S, Wright P, Pesola M, Warner L, Löyttyniemi E, Minn H. Validation of automated magnetic resonance image segmentation for radiation therapy planning in prostate cancer. Phys Imag Radiat Oncol. 13:14-20, 2020.

Depauw N, Keyriläinen J, Suilamo S, Warner L, Bzdusek K, Olsen C, Kooy H. MRI-based IMPT planning for prostate cancer. Radiother Oncol. 144:79-85, 2020.

Automated segmentation tools for radiotherapy using deep learning algorithms

Manual segmentation of the OARs per patient can take a long time even for an experienced clinician. Depending on the disease and its location, it can vary from a few minutes to an hour. By using accurate and robust automated segmentation algorithms, up to several hours of segmentation work can be automated, whilst the contributions of clinicians can be relieved for other important tasks, such as a doctor's practice.

The automated segmentation tool uses branches of machine learning called deep learning (DL). DL is a subfield of machine learning concerned with artificial neural networks, which are models inspired by the structure and function of the brain. DL models try to find good multiple level representations of the unknown input distribution in a hierarchical fashion, similarly as e.g. in the human visual cortex. These automatically learned abstract features allow the constructed multidimensional functions to produce an output from input without the features of human designed functions. In this project, the problem distribution is a medical imaging dataset and the target output to be learned by the artificial neural network are the segmented contours of regions of interest, such as target and OARs.

A tool capable of producing automatically segmented target and OAR structures on CT and MR images of various cancer sites, e.g. prostate, breast and brain, is studied, developed and validated. The overall objective of the work is to automate the entire process of target and OAR segmentation required for the RTP. Hundreds of anonymous CT and MR images with manually segmented target and OAR structures are retrospectively collected to be used as an input distribution for level-feature learning of the DL algorithm.

The retrieval and anonymization tasks of the patient images and corresponding segmentations from the image database can be automated by a database daemon script. This project is carried out in a close collaboration with other hospitals and MVision AI Oy (Helsinki, Finland) that is able to provide the development work and training for the DL-based workflow. Evaluation, validation and testing parts are put into an action by the clinicians and physicists. Traditional evaluation metrics, e.g. Dice coefficient, difference between the volumes and the 95% Hausdorff distance, are used to compare the outcome with the ground truths defined by clinicians. Obviously, the project also includes fitting the application into a clinical workflow in order to significantly lower the working hours spent for image segmentation.

Publications:

Kiljunen T, Akram S, Niemelä J, Löyttyniemi E, Seppälä J, Heikkilä J, Vuolukka K, Heikkilä V-P, Lehtiö K, Nikkinen J, Gershkevitsh E, Borkvel A, Adamson M, Zolotuhhin D, Kolk K, Pang EPP, Tuan JKL, Master Z, Chua MLK, Joensuu T, Kononen J, Myllykangas M, Riener M, Mokka M, Keyriläinen J. A deep learning -based automated CT segmentation of prostate cancer anatomy for radiation therapy planning - a retrospective multicenter study. Diagnostics. 10:959, 2020.

Biologically guided radiotherapy

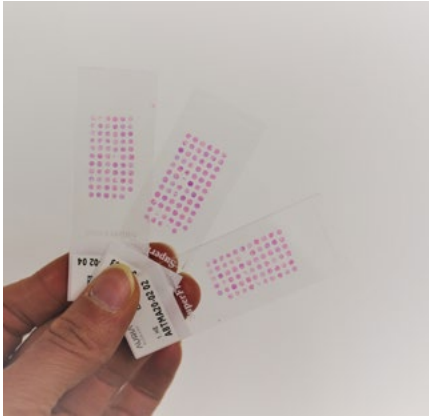
The RT department collaborates with Turku PET Centre in combining anatomical, metabolic positron emission tomography (PET) and functional MRI with RT. Our interdisciplinary research include both dose painting by numbers based on the hypoxic agent EF5 and investigation of predictive factors for head and neck cancer patients, as well as acetate based dose escalation of intraprostatic lesions. The research conducted includes both long-term evaluation of treatment outcomes and development of future methods for RT delivery.

Publications:

Kuisma A, Wright P, Suilamo S, Seppälä J, Koivisto M, Lindholm P, Minn H. Long-term outcome of biologically guided dose-escalated radiotherapy of localized prostate cancer. Acta Oncol. Online ahead of print:1-7, 2021.

Wright P, Røthe Arnesen M, Lønne P-I, Suilamo S, Silvoniemi A, Dale E, Minn H, Malinen E. Repeatability of hypoxia dose painting by numbers based on EF5-PET in head and neck cancer. Acta Oncol. 60:1386-1391, 2021.

Highlights in research infrastructure



Auria Biobank

The aim of biobanks is to promote health by providing a research infrastructure for biomedical research. Biobanks collect biological samples and related clinical data from patients who have given biobank consent to be used for research purposes. The donation of a sample to biobank is voluntary but highly valuable for biomedical research. The data generated in the biobank studies helps to understand diseases and supports the development of new personalized therapies. The results from biobank studies return to biobank adding value to the samples.

Auria Biobank is the oldest Finnish hospital biobank established in 2012 by University of Turku and the hospital districts of Southwest Finland, Satakunta and Vaasa. Auria is the operating biobank in the respective hospital districts.

Over 1,5 million human biological FFPE tissue samples are stored at Auria Biobank. There is an ongoing collection of also other sample types such as plasma, serum, cerebrospinal fluid CSF and DNA. Genotype data is also available for a proportion of samples. Approximately one fourth of Auria's samples are cancer tissue samples. The samples are collected as part of normal diagnostics or treatment.

Clinical data collected as part of patient treatment in the hospital can be linked to the biobank samples. Based on e.g. genotype information and clinical parameters, Auria Biobank is able to recall defined groups of patients for clinical trials. Auria has extensive experience in serving both academic research as well as pharmaceutical and diagnostic industry. The abstracts of the >200 biobank studies are collected at Auria's web pages (www.auria.fi).

https://www.auria.fi/biopankki/
Perttu Terho, Acting Director
Merja Perälä, Project Manager

Turku Center for Disease Modeling

The TCDM is a research and research service organization of the Faculty of Medicine in the University of Turku. It is also a part of the Biocenter Finland "Model Organisms" network. TCDM provides state-of-the-art research facilities and expertise in studies involving experimental animals to support preclinical research for academic and industry purposes.
Rodent studies in vivo are an essential part of studies aiming for understanding mechanisms of tumor growth and treatment responses. TCDM offers expertise e.g. 1) to generate and study xenograft models in mice and rats, 2) to generate and maintenance genetically modified mouse models for cancer research, and 3) has expertise to perform chemically induced cancer models in mice. TCDM personnel are qualified to perform various surgical and pharmacological interventions in preclinical studies. The experimental studies in rodents are supported by several image-analyzing techniques allowing to follow tumor growth metabolism, including optical, PET and ultrasound imaging. Direct connections have been also built to facilities providing histological services and molecular pathology at the Institute of Biomedicine. TCDM holds a spectrum of slide scanners enabling the digital pathology services for experimental cancer models, and has recently established a platform for high resolution laser microdissection of histological section and cells. In activities carried out together with Auria Biobank and Turku Prostate Cancer Consortium, TCDM has established methods to generate patient-derived cell lines from various cancers and their benign counterparts, providing the potential to generate models for personalized models and e.g. for drug sensitivity testing carried out together with Misvik Biology.

https://www.tcdm.fi/
Matti Poutanen, Professor, Director of TCDM
Petra Sipilä, Adjunct Professor, Vice Director of TCDM

AURIA CLINICAL INFORMATICS

FINDATA PARTNER

Auria Clinical Informatics

Auria Clinical Informatics (ACI) supports scientific research, education and data-driven management based on the secondary use of patient records in specialized healthcare. ACI serves both basic academic research and industry-sponsored scientific studies and its services for researches include:

- Feasibility reports on data availability
- Study planning support
- Data extraction
- Statistical analyses
- Access to a secure data analytics platform

Cancer studies based on patient records often require tight collaboration between ACI and local clinicians. The suitability and coverage of the patient records data need to be evaluated from a technical and clinical perspective. For this purpose, ACI has created a wide network of oncologists, surgeons and pathologists treating cancer patients and doing cancer research at the Hospital District of Southwest Finland.

In fact, ACI has supported ca. 70 cancer studies based on patient records in 2019-2021. In the future, we see the demand for patient records data growing for cancer research. A rising trend is to form control cohorts for clinical studies based on patient records.

For the Tyks Cancer Center, ACI has created and maintains statistics for times to treatment in selected cancer types for presentation on the public website of TYKS. In addition, ACI maintains a more detailed internal cancer treatment dashboard for the TYKS Cancer Center for data-driven management purposes.

https://www.auria.fi/tietopalvelu/en/
Arho Virkki, Head of Auria Clinical Informatics

Turku PET Centre

The Oncology research group assesses prospectively new hybrid imaging technologies and acquisition protocols with standard and new tracers at the Turku PET Center. The aim is to increase the clinical impact and diagnostic accuracy of PET imaging and PET-related research. Moreover, possibilities of new AI technologies with deep learning capabilities are being investigated for facilitating and improving diagnostic analysis of oncological PET images.

Innovations through translational research by local and international collaborators are being evaluated for immune cell interaction studies, for circulating tumor DNA and microenvironment in relation to molecular imaging which may guide immunotherapy, for biologically planned adaptive radiotherapy, and for particle therapy.

We are currently studying the development of chemotherapy resistance and hypoxia in ovarian cancer with PET imaging in clinical studies by developing artificial intelligence methods to identify effective treatment modalities. Hypoxia is one of the most important drivers of chemoresistance in cancers. Tumor hypoxia can be evaluated preoperatively with PET with the novel tracer EF5 (18F-[2-82-nitro-1-H-imidazol- 1-yt)-N-(2.2,3,3,3-pentafluoropropyl) acetamide]).

Prostate specific membrane antigen (PSMA) targeted PET/CT or PET/MRI represents a very promising imaging method for prostate cancer diagnosis, staging and treatment response evaluation. To improve the diagnostic accuracy in staging of high risk prostate cancer, we have multiple ongoing studies comparing the new novel imaging methods to conventional guideline imaging (Bone scintigraphy and CT) in primary staging of prostate cancer.

Fibroblast activation protein (FAP) is a very promising molecular target for imaging and therapy in cancer. 18F-labelled FAP inhibitors PET-CT/MRI research will be one of the major interests of our group in the near future in various types of cancers.

Theranostics refers to the use of molecular probes that have both diagnostic and therapeutic properties; these probes have a radionuclide attached, e.g., 177-Lu or Ac-225. We are also studying PSMA receptors and somatostatin receptors in phase I trials and in archival biobanked material for their potential as targets for alpha- and beta-emitting radionuclide therapy.

A recent grant from the Academy of Finland will support a prospective study on the effects of physical activity on the response to anticancer treatment. Additional funding is provided by the Finnish Cancer Organization, the Nordic Cancer Union, and European Union. Currently we are installing a total body PET/CT scanner, Siemens Vision

Quadra, which allows dynamic whole torso imaging in patients with cancer. This will further enhance our possibilities for cancer research.

https://turkupetcentre.fi/
Professor Juhani Knuuti, Director of Turku PET Centre.

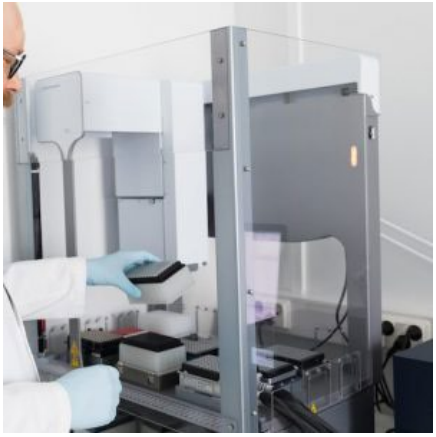
Turku Clinical Research Center (TurkuCRC)

The goals of the research services of the hospital district are to reinforce the prerequisites of scientific research, to guarantee the quality of research, to ease the workload of the study groups by managing the administration of the research and to make co-operation with external stakeholders faster and more efficient.

- The research services
- support the ethics committee
- process research contract issues
- administer state health research funding
- administer EU-projects

TurkuCRC and the University of Turku function as a guide and advisor for researchers and commissioners in the planning of research projects and in acquiring support services needed for by the research team and to follow that laws, acts, regulations and the GCP principles are duly followed. In addition, TurkuCRC provides monitoring services to investigator-initiated research projects and organizes education in the field of healthcare research to scientists and other research staff.

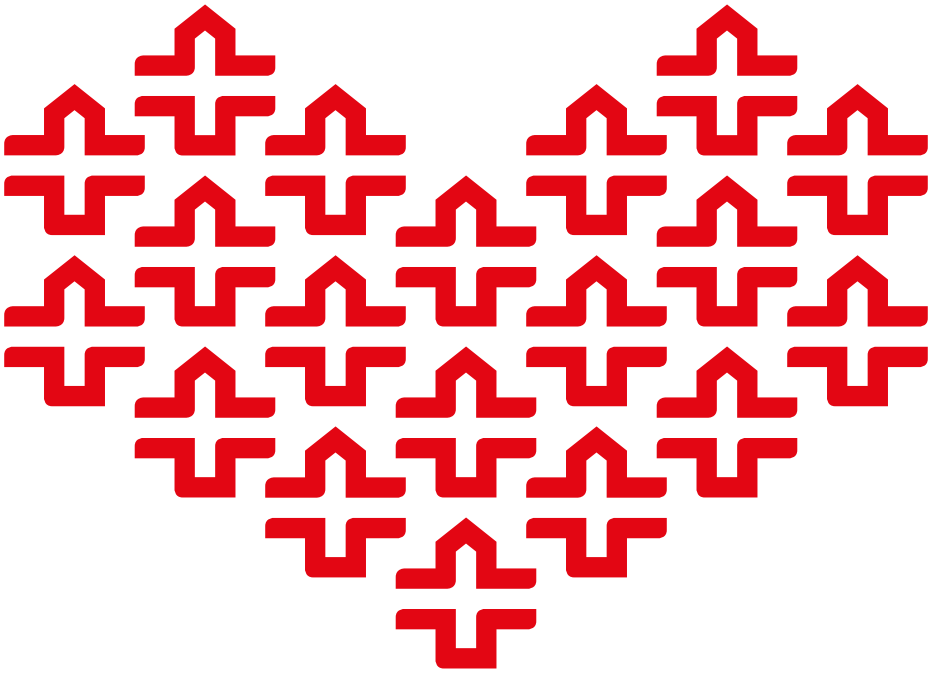
http://www.turkucrc.fi/
Päivi Rautava, professor, Director of TurkuCRC



Finnish Functional Genomics Centre

Finnish Functional Genomics Centre (FFGC) is a national core facility for genomics services and a testing laboratory No. T351 accredited by FINAS Finnish Accreditation Service for production of sequence raw data for various further analyses from genomic DNA with next-generation sequencing (ISO 17025). FFGC operates at the Turku Bioscience Centre, which is a joint department of University of Turku and Åbo Akademi University and belongs to the national Biocenter Finland infrastructure network. FFGC supports high level research by providing open access to the state-of-the art technologies and services with the latest methods available for genome analysis. Currently the most important services include next-generation sequencing based analysis of genomes, exomes, transcriptomes, epigenomes and metagenomes. The service users include academic and government's research units, health care units and organizations from private sector. FFGC continuously develops and improves the provided services in close collaboration with the key stakeholders, such as Molecular Tumor Board to develop services for cancer diagnostics, and in collaboration with the Genomics Unit of Turku University Hospital Laboratories provides services for exome and whole genome sequencing.

https://bioscience.fi/services/functional-genomics/services/
Riikka Lund, PhD, Adjunct Professor, Head of FFGC



Parannamme joka päivä

TYKS

OECI CANCER CENTRE