



HEALTH TECHNOLOGIES RESEARCH AND TEACHING AT TALLINN UNIVERSITY OF TECHNOLOGY

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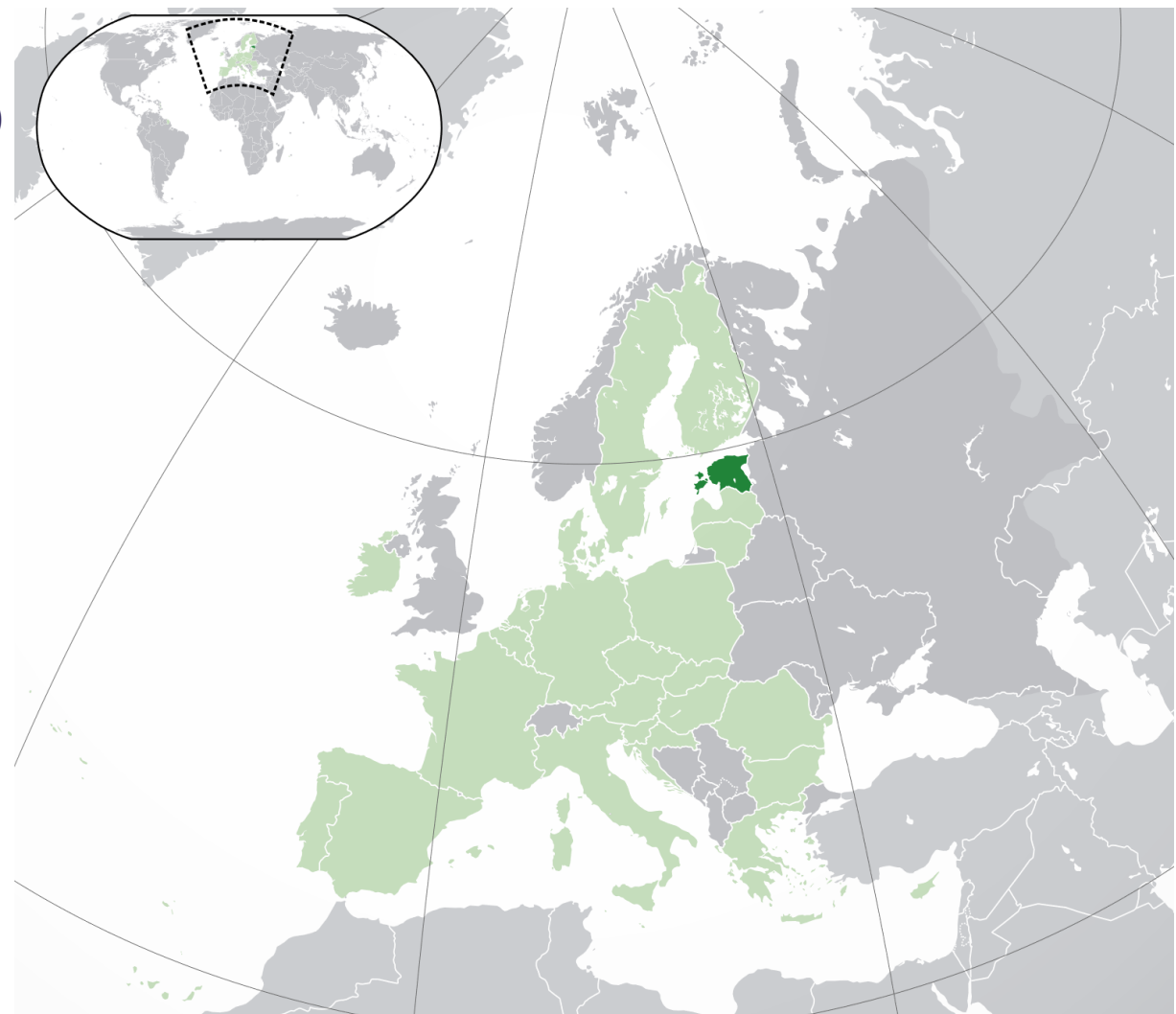


OUTLINE

- Some facts about Estonia, hospital network and health care system
- Introduction to Estonian e-services
- Estonian e-health system
- Tallinn University of Technology (TalTech)
- Health technologies at TalTech

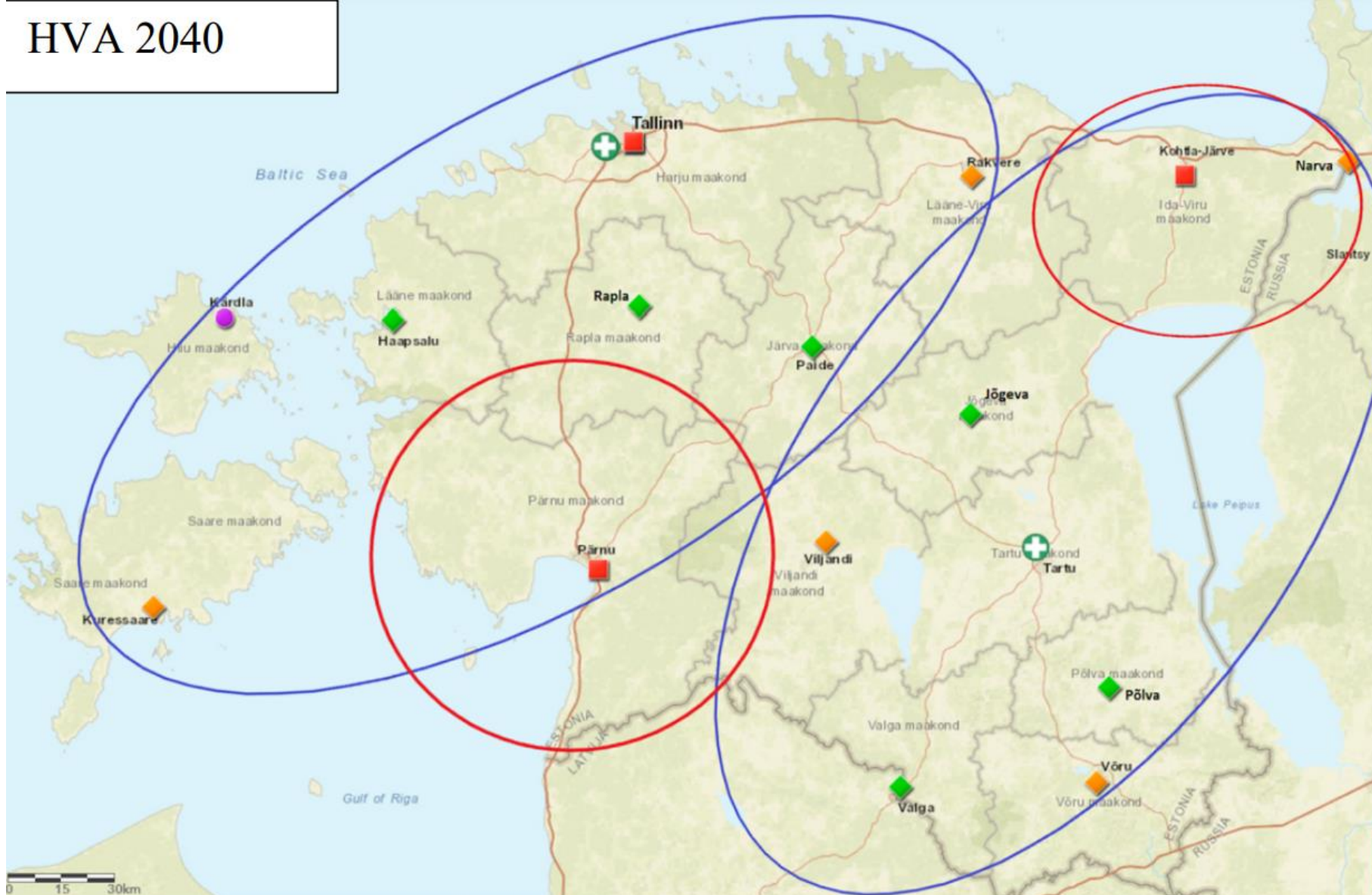
ESTONIA

- Estonia's population is 1.36 million (area 45 339 km²)
- Every citizen has a unique ID-code (ID-card is mandatory)
- The NATO Cooperative Cyber Defense Centre of Excellence has been located in Estonia since 2008.
- Estonia is the birthplace of innovative companies like Skype, Playtech, Wise, Bolt, and Pipedrive.
- Individuals worldwide can apply to become e-residents of Estonia.



HVA 2040

HOSPITAL NETWORK



- Regional hospital
Tartu Ülikooli Kliinikum
Põhja-Eesti Regionaalhaigla
- Central hospital
Tallinna Haigla
Ida-Viru Keskhaigla
Pärnu Haigla
- General hospital
Kuressaare Haigla
Rakvere Haigla
Narva Haigla
Viljandi Haigla
Lõuna-Eesti Haigla
- Community hospital
Läänemaa Haigla
Raplamaa Haigla
Järvamaa Haigla
Jõgeva Haigla
Põlva Haigla
Valga Haigla
- Small general hospital on the island
Hiiumaa Haigla

- Catchment area for regional hospital
- Catchment area for central hospital



TALLINNA

ESTONIAN HEALTH CARE SYSTEM

- Unified national health insurance
- Is based on compulsory solidarity-based health insurance.
- 13% health insurance contribution deducted from the salaries of employed individuals.
- The Estonian Health Insurance Fund covers the medical expenses of insured individuals.
- Health care services are made available mostly by private service providers.
- The management and supervision of health care system and development of health policy is under the scope of the Ministry of Social Affairs and its agencies.

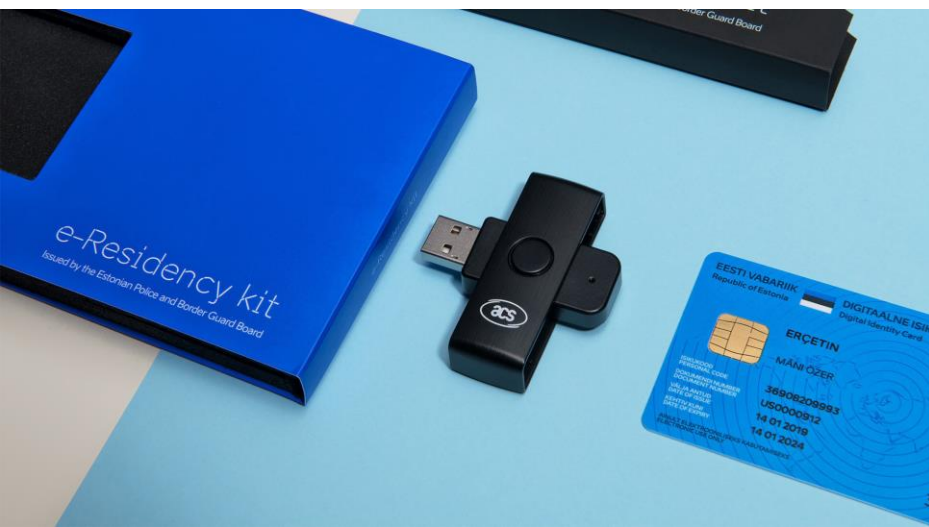




E-GOVERNANCE



- In Estonia, 99% of public services are available online 24 hours a day.
- E-services are only impossible for divorces – you still need to leave the house for this.
- Among some of the most popular digital services in Estonia are: the Tax and Customs Board, the Patient Portal, e-File, and the e-Business Register.
- 99% of financial transactions (bank transfers) are made in e-bank
- 98% of income tax declarations are made via the E-Tax Board (2023)
- 51,1% of votes were e-votes (2023)
- 119 000 e-Residents from 184 countries across the world
- 33 000 e-resident companies established by e-residents



E-SOLUTIONS AND SERVICES



e-Identity

- ID-card
- Mobile ID
- e-Residency
- Smart ID

[LEARN MORE](#)



Cyber security

- Secure data sharing
- KSI blockchain
- Cyber range & exercises

[LEARN MORE](#)



X-Road — interoperability services

- X-Road
- NIS
- UXP

[LEARN MORE](#)



e-Health

- e-Health record
- e-Prescription
- e-Ambulance

[LEARN MORE](#)



e-Governance

- e-Services & registries
- e-Democracy & open data
- Government cloud
- Data Embassy
- Justice & public safety

[LEARN MORE](#)



Smart city and mobility

- Smart freight transportation
- Intelligent transport infrastructure
- Seamless passenger mobility

[LEARN MORE](#)



Ease of doing business

- e-Tax
- e-Banking
- e-Business Register
- e-Residency

[LEARN MORE](#)



e-Education and research


- School management systems
- Digital tools & learning materials
- Digital skills


[LEARN MORE](#)

Welcome!


E-services for citizen




 My prescriptions


 Certificates of temporary incapacity for work

 Ordering the European Health Insurance Card

 My identity documents and photo

 Account number and personal data in the Health Insurance Fund

 Notarised documents

 Dental care benefit and denture benefit information

 Traffic insurance history


[Log in to the self-service for citizen →](#)

E-services for entrepreneurs




 Entrepreneur's dashboard

 Notarised documents

 Management of certificates of incapacity for work

 Traffic insurance history

 Searching for a vehicle without insurance contract

 Personal data query

 Applications to the Social Insurance Board

 Child support debt

[Log in to the self-service for entrepreneurs →](#)


Proactive government services

 Getting married
Citizen

 National defence obligation
Citizen

 Settling in Estonia
Citizen

 Having a baby
Citizen

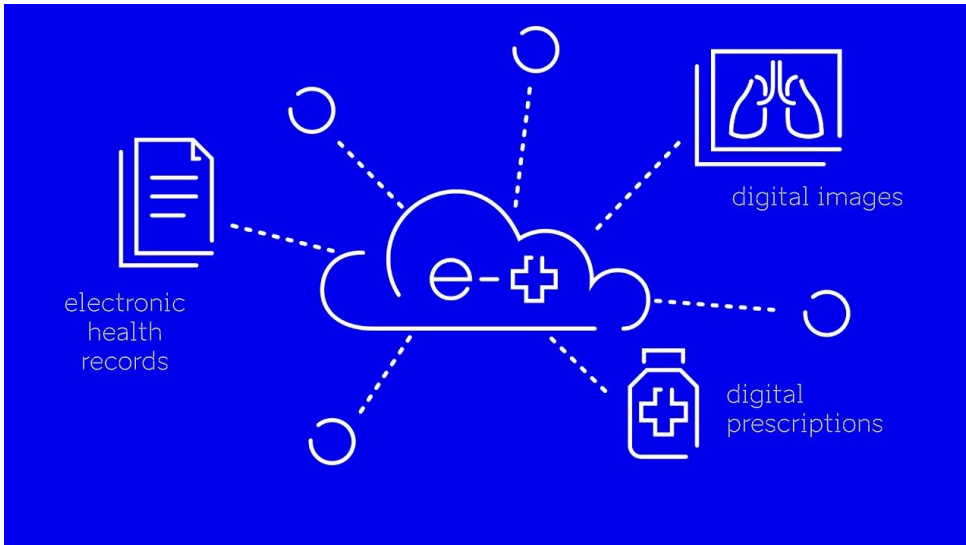
 Death of a loved one
Citizen

 Financing
Entrepreneur

 My Pension
Citizen

ESTONIAN HEALTH INFORMATION SYSTEM (EHIS)

- Covers the entire nation, registering residents' health data from birth to death.
- Built on a standard-based IT infrastructure ensuring robust digital functionality.
- Facilitates mostly digital medical data exchange across all healthcare levels.
- Some records remain on paper, including intensive care notes, in-hospital orders, and nursing documentation.



Your gateway to health services

In the Health Portal, you can find topics related to maintaining your health, view your health data and use various services (formerly digilugu.ee).

[Log in to the Health Portal](#)



Referrals and appointments



Prescriptions



Results of tests and examinations



Health certificates and how to apply for them

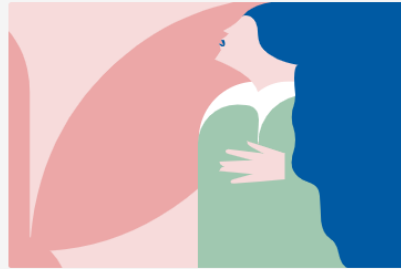


Data in the health care system



Vaccination information

Screenings



Breast cancer screening

10.01.24

For the early detection of breast cancer, we invite women born in 1950, 1954, 1956, 1958, 1960, 1962, 1964, 1966, 1968, 1970, 1972, 1974 to a free breast cancer screening.

[See more](#)



Colorectal cancer screening

10.01.24

Men and women aged 60–68 are invited to the screening for colorectal cancer every two years.

[See more](#)



Cervical cancer screening

10.01.24

Cervical cancer screening In Estonia, women aged 30-65 years are invited for cervical cancer screening at five-years intervals In 2024 we invite women (including uninsured) who are born in 1959, 1964, 1969, 1974, 1979, 1984, 1989, 1994.

[See more](#)

News



Is your family doctor using a digital service platform?

23.10.24

You can now check on the Health Portal whether your family doctor utilizes a digital service



Tartu University Hospital and the Health Insurance Fund remind you that one decision can save many lives



Now you can purchase prescription medications with e-prescriptions across all Baltic countries

Health Information



Medical care

If you have a health concern, it is possible to first see your family physician or family nurse. Round-the-clock medical advice is available via the family physician advisory line (+372) 634 6630 or the paid phone number 1220. You can also call the family physician advisory line if you are in doubt whether your health condition requires going to the emergency medical department or calling an ambulance.



Patient guides

These guides provide information about various disorders or medical procedures in simple terms. Patient guides give recommendations from the patient's point of view, i.e. what you or your family member needs to know about the nature of your disease, treatment, and organising daily life.



Dental health

Regular oral hygiene prevents tooth decay and cavities. Appropriate oral care requires brushing teeth at least twice daily, cleaning the interdental spaces at least once daily, and seeing a dentist on a regular basis at least once a year.



Medications and safety

By using medicines properly and safely, you ensure that they are effective and prevent possible adverse effects and risks. You can always ask the pharmacist, family physician, or family nurse for explanations on using medicinal products and the adverse effects thereof.



Health maintenance

Everyone is in control of their own health. Health maintenance is an active and conscious act for preserving and promoting your well-being, preventing diseases, and improving your physical and mental health with the help of a healthy lifestyle and preventive measures.



Surveys, tests and tools

Please see references for tests and auxiliary materials to check how healthy your eating habits are and how to make conscious and health-supporting choices

[More information](#)

Portal Services



Tests and examinations

Results of your examinations that help health care professionals monitor and assess your health condition.



Dental health

Overview of your dental status and summaries of previous dental appointments.



Dental health

The validity of your medicinal product and medical device prescriptions and other data.



Certificates and declarations

You can view your health certificates and check their validity. A declaration of health must be completed to apply for a medical certificate.



Vaccinations

Enables you to view administered vaccinations and recommendations for future vaccinations. Vaccinations are one of the most important preventive measures used to control the spread of infectious diseases and protect the health of individuals.



Appointments requiring a referral

Your valid referrals, the respective appointments, as well as invalid, i.e. used referrals.

[More about the services](#)

- My Dashboard
- Appointments and Referrals
- Prescriptions and Medical Devices
- My Health History
- Dental Health
- Vaccination
- Health Certificates and Declarations
- Working Ability
- Treatment Costs
- My settings
- Logs

Jana Holmar

Insured | Health Insurance Fund

Dental care benefit balance 60 €

- Work ability**
E.g sick leave certificates, work ability assessments [View →](#)
- Representation rights**
Allows sharing access to your health data [View →](#)
- Driver's license certificate**
Valid until 14.10.2025 [View →](#)
- Your dental health**
Overview of your appointments [View →](#)

National eBooking system
Book and change upcoming appointments

[Book appointment ↗](#)

My statements of intention
For example organ donation and blood transfusion

[View statements of intention →](#)


My family physician: Liis Mägi
Contact your family physician through e-Perearstikeskus

[Open e-Perearstikeskus ↗](#)

Examinations, tests and appointments of the last six months

📅	17. OCTOBER 2024	Immunisation Influenza virus Show summary ▾	View →
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If you have any questions, please contact the person who issued the document [View health history →](#)


You do not have any bookable referrals, upcoming appointments, undispensed prescriptions.

How do you rate your satisfaction with the Health portal?

very bad
 bad
 average
 good
 excellent



★ Contact customer support



**TAL
TECH**

**TALLINN UNIVERSITY
OF TECHNOLOGY**

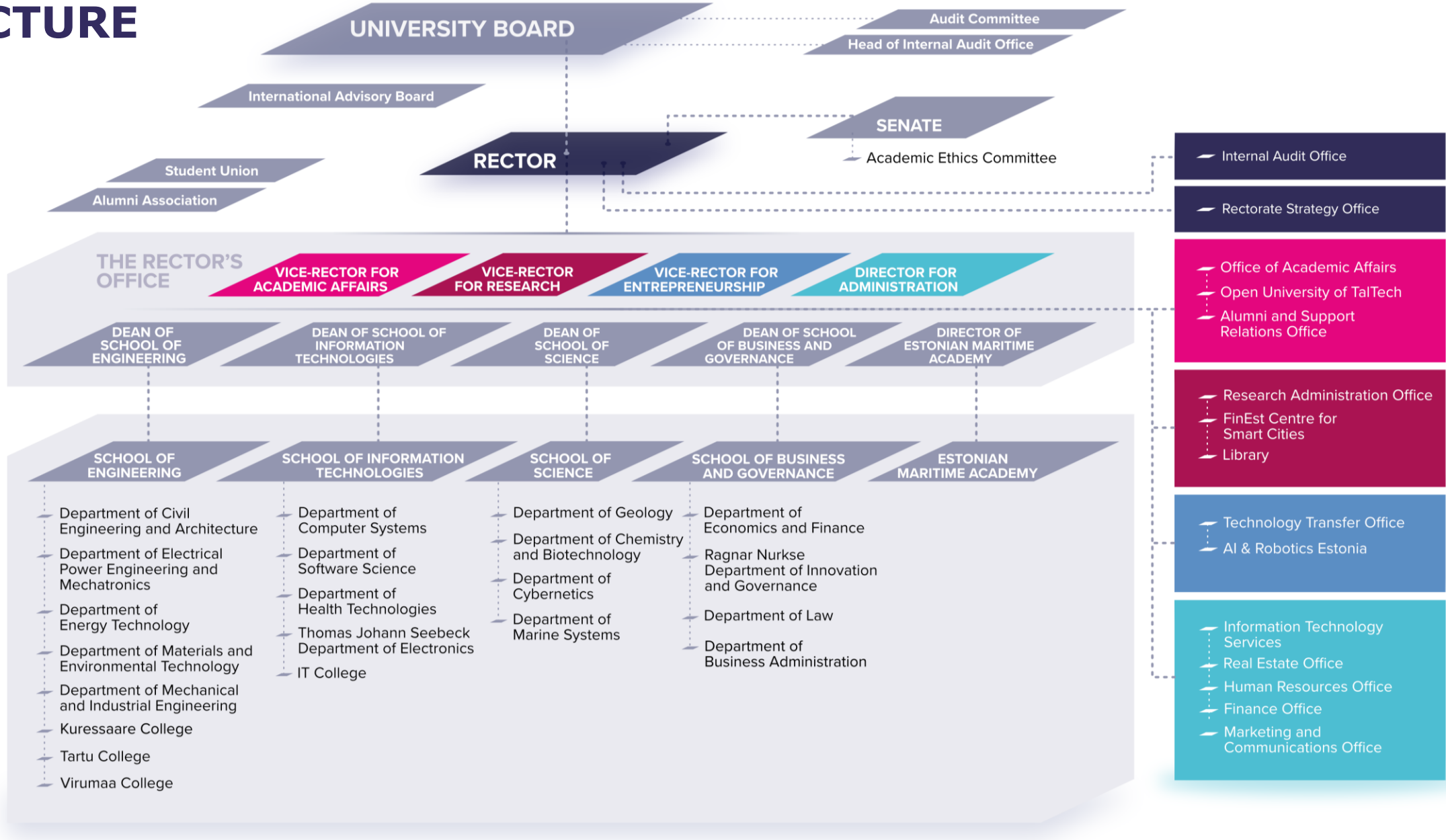
TALLINN UNIVERSITY OF TECHNOLOGY

To lead Estonia and the world into a sustainable digital future

- Founded in 1918, TalTech is the sole technological university in Estonia. It is also the most international university in Estonia. Of the nearly 10,000 enrolled students, approximately 16% come from 100 different countries across the globe.
- TalTech is a research-based university offering Bachelor's, Master's and Doctorate degrees in **technology, applied science, IT, business and maritime studies**.
- As a leader in science, technology, and innovation, the school maintains constant interaction with universities around the world, bringing together scientists, students, and entrepreneurs.



STRUCTURE 2024



TALLINN UNIVERSITY OF TECHNOLOGY 2023

An aerial photograph of the Tallinn University of Technology campus, showing various buildings, green spaces, and a road. The image is used as a background for the statistics overlay.

8,846
students

876 International students
from **85** different countries
80 study programmes
5 joint programmes
23 international programmes

2,050
employees

67 nationalities
44.92 average age
146 professors

1,249
publications

73 PhD degrees awarded
49% international PhD students

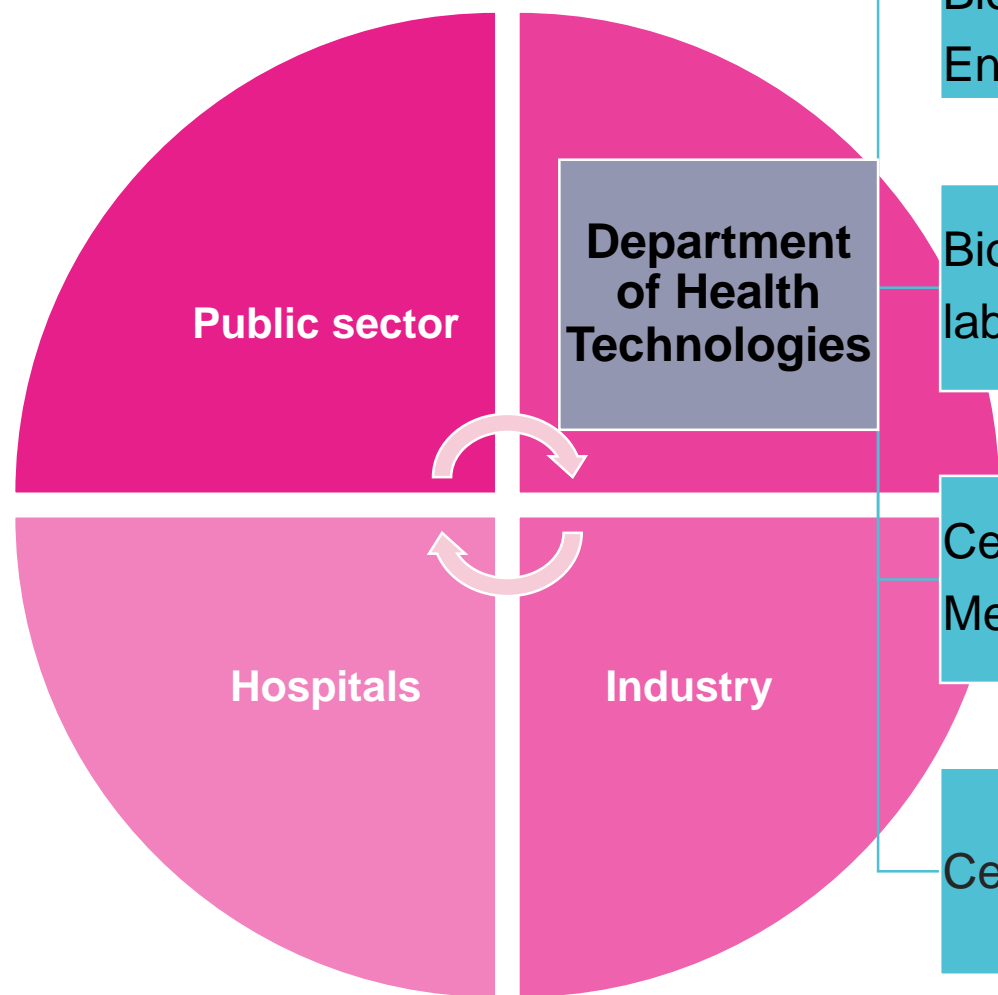
82,507
alumni

3.7% international alumni

HEALTH TECHNOLOGIES IN TALTECH

- Health technologies are one of TalTech's research focus areas.
- Health technologies are addressed across all faculties, comprehensively and interdisciplinarily.
- We offer complementary technological expertise to medical competencies.
- The Focus Center for Health and Food Technologies ensures internal coordination and information exchange.

**TAL
TECH**



Centre for Biomedical Engineering

Biosignal processing lab

Centre for Cardiovascular Medicine

Centre for Digital Health

PhD studies

Master curriculars

Additional education

Medical technology and -physics

Digital Health

Digital skills

Health-analytics

Electrical safety of medical devices

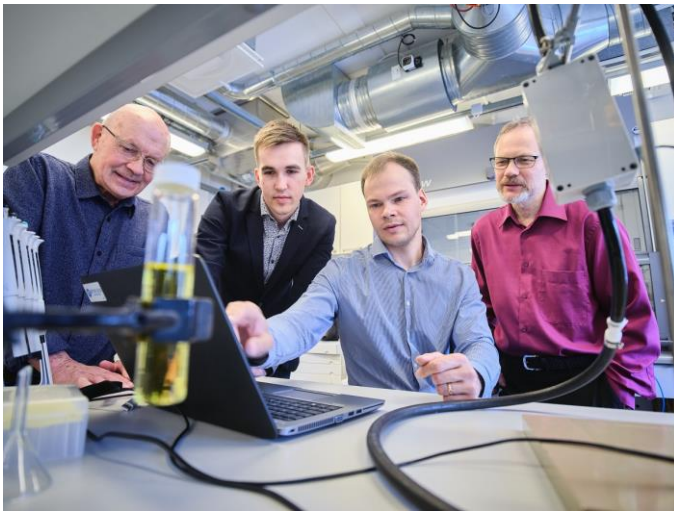
Radiation safety

RESEARCH GROUPS

- **Centre for Biomedical Engineering**

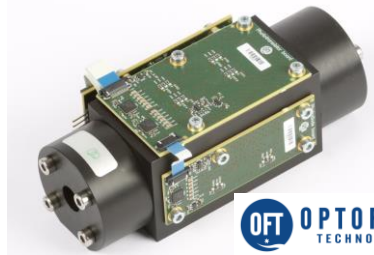
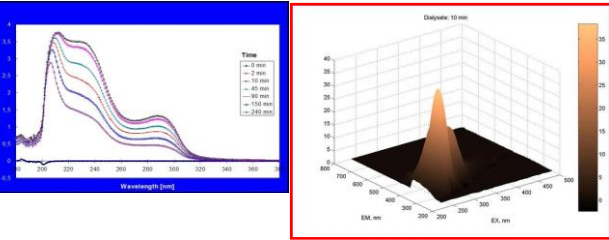
Head - prof. Ivo Fridolin

Sensors, algorithms, sensor fusion, biofluid optics, uremic toxins, dialysis, on-line monitoring, spectrophotometry, spectrofluorimetry, signal processing, smart workwear, physical activity monitoring, energy consumption, fatigue monitoring, automatic speech recognition, speech-to-text applications, wellbeing score.



Optical monitoring of dialysis

THE FIRST REAL-TIME SENSOR FOR SMALL, MIDDLE AND PROTEIN BOUND RETENTION SOLUTES' REMOVAL MONITORING IN THE SPENT DIALYSIS

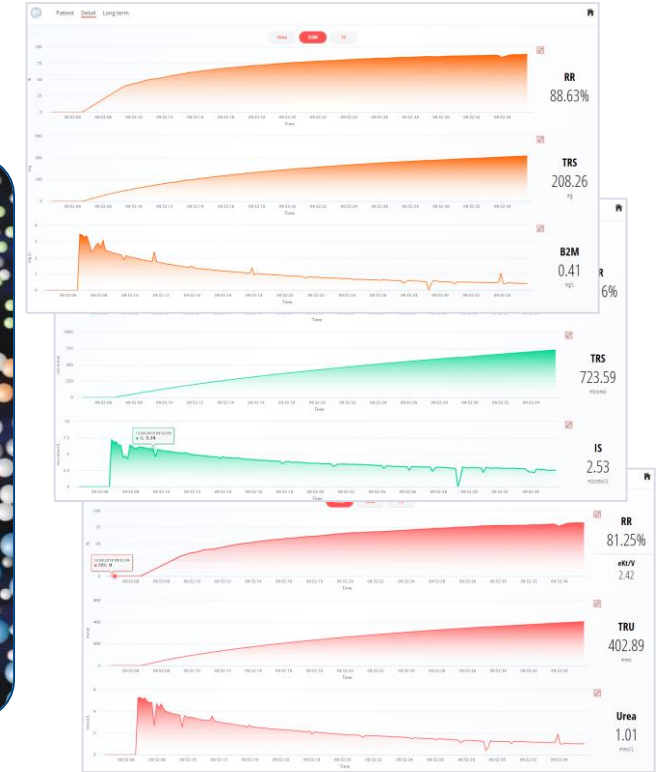
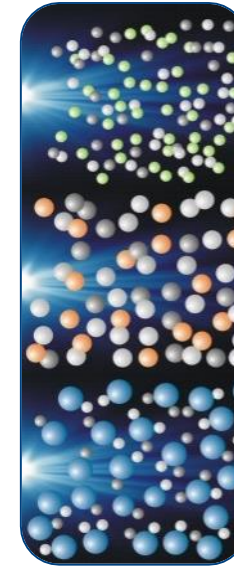


OFT OPTOFLUID TECHNOLOGIES

MCM™ sensor



		Reduction Ratio	Total Solute Removal
Small Molecules < 500 Da	Urea (+TRU, nPNA)	✓	✓
	Uric Acid	✓	✓
Middle Molecules 0.5 – 60 kDa	β2-Microglobulin	✓	✓
Protein Bound Molecules	Indoxyl Sulfate	✓	✓



Breakthrough technologies for an implantable artificial kidney

Consortium

- University Medical Centre Utrecht (NL)
- Utrecht University (NL)
- Imec Eindhoven (NL)
- Imec Leuven (BE)
- The Laboratory for Interdisciplinary Physics (FR)
- Optofluid Technologies OÜ (EST)
- ME-SEP (PL)

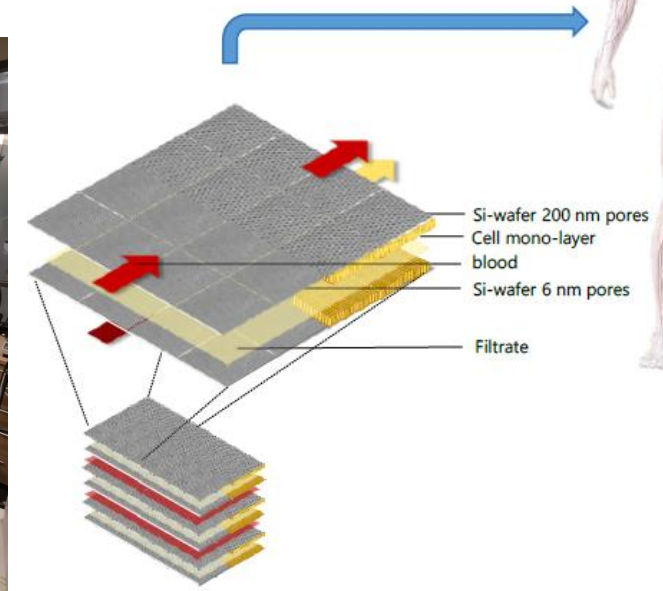
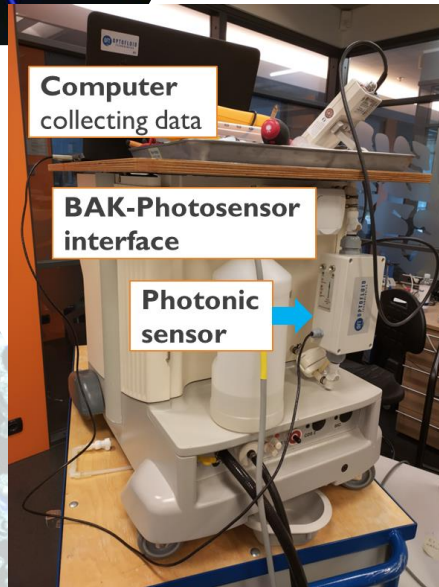
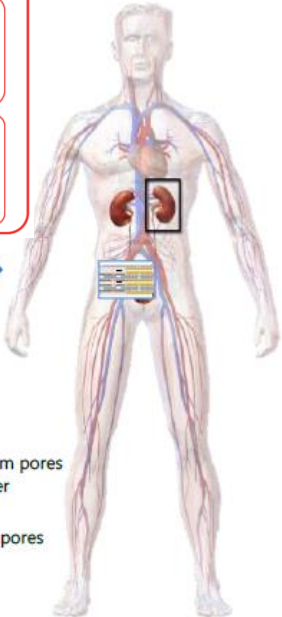
Kidney Failure: Present therapies are inadequate!



- Best & cheapest available KRT option, **but:**
- Structural Shortage of Transplant Kidneys, many Patients Die, while still on the Waiting List
 - Immune suppression drugs prevent transplant rejection but also increase Risk of Cancer & Infections
 - Still up to 25% shorter remaining Life Expectancy



- Most widely used available KRT option, **but:**
- Substitutes max 10-15% of kidney filtration function
 - Does not substitute all other kidney functions
 - Significantly lower Quality of Life than Transplantation
 - More Expensive & Resource-heavy than Transplantation
 - Up to 70% shorter remaining Life Expectancy



<https://www.kidnew.eu/>



Funded by the European Union

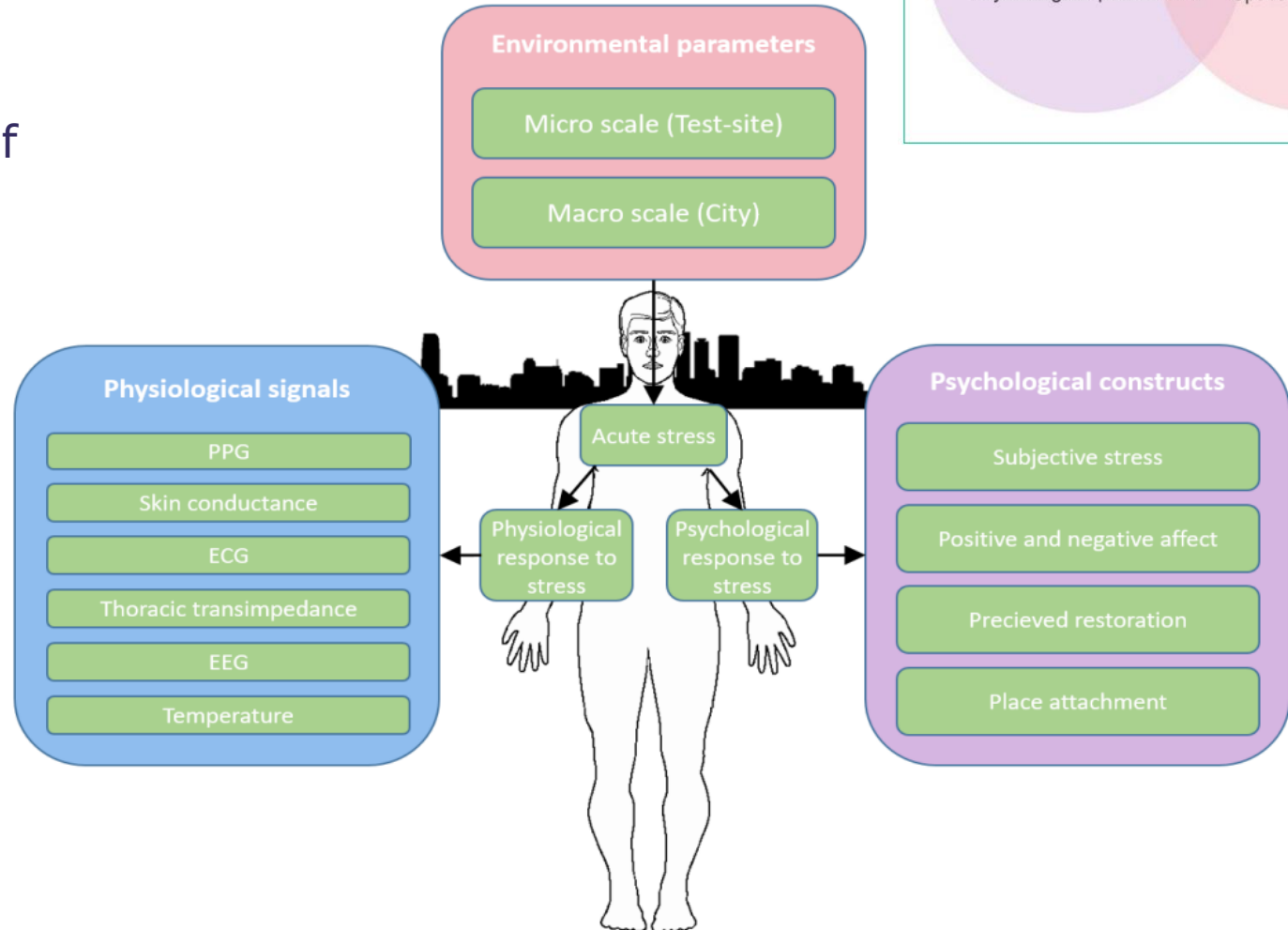
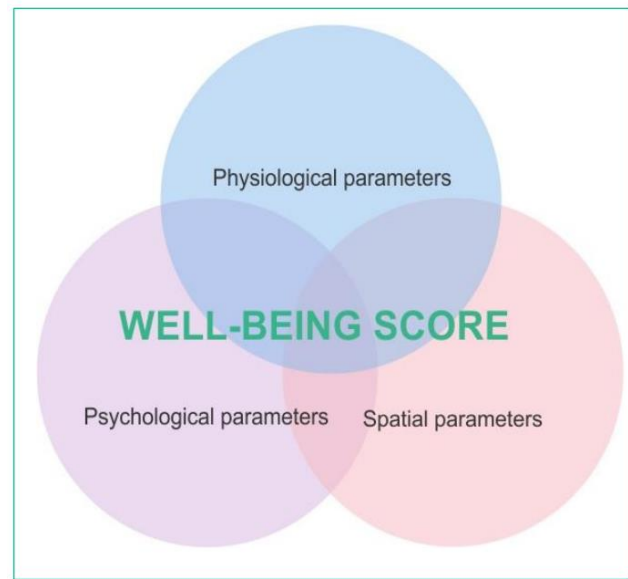
The project has received funding from the European Innovation Council and SMEs Executive Agency HORIZON-EIC-2022-PATHFINDEROPEN-01 Program under the Grant Agreement N°101099092

European Innovation Council



WELL-BEING SCORE (WBS)

- [Urban Planning Well-being Score service ENG – YouTube](#)
- The project aims to bridge the gap between urban planners and urban residents to develop a well-being score based on measurable indicators to evaluate the qualities of built environment integrating the citizens' psychological and physiological states in relation to spatial parameters.
- WBS aims to be:
 - as an input for data-driven and more objective city planning
 - monitoring tool of the well-being in the city districts



RESEARCH GROUPS

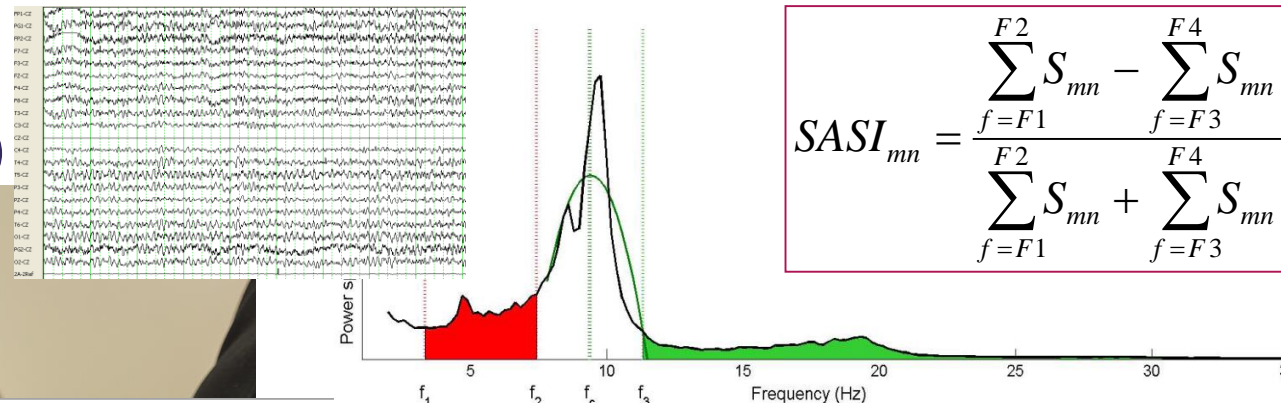
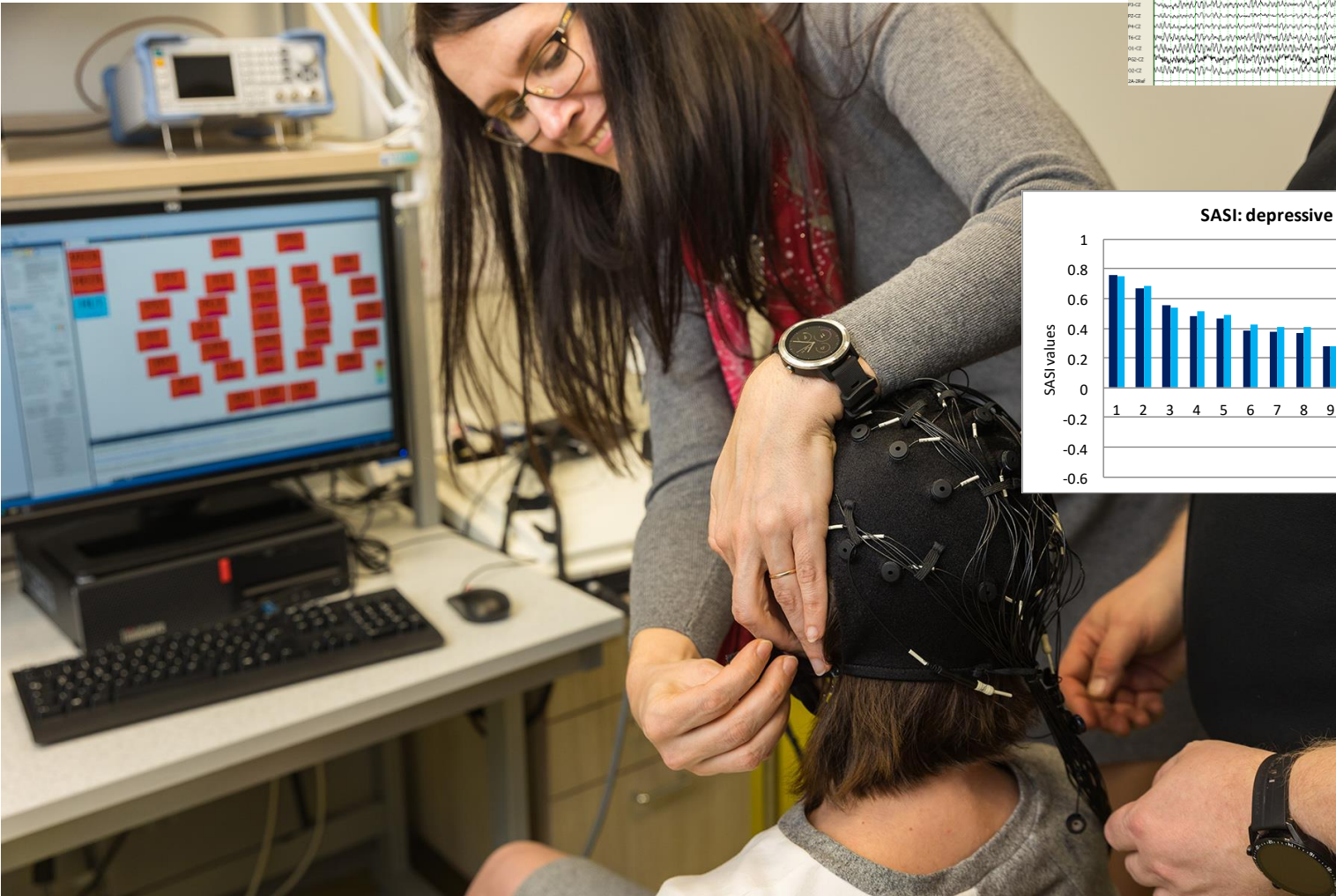
- **Biosignal Processing Laboratory**

Head - prof. Maie Bachmann

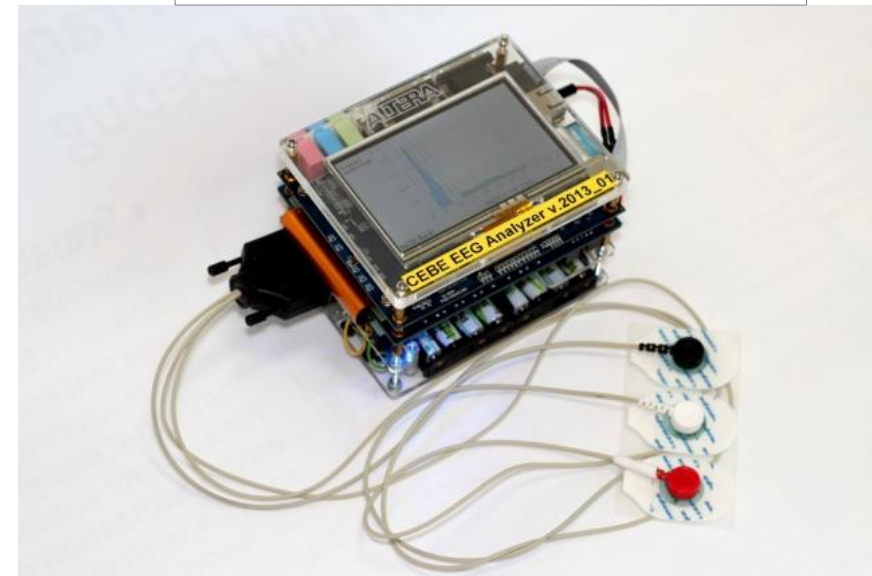
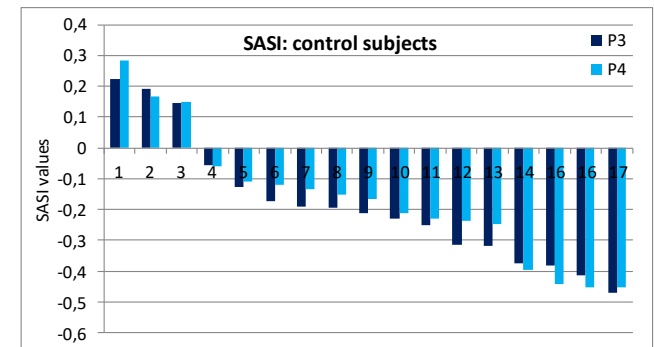
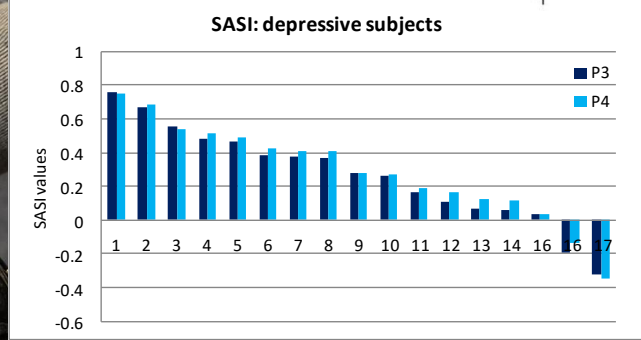
Signal processing, electroencephalography, mental disorders, depression, sleep, environmental stressors



NEW METHOD OF EEG ANALYSIS – SPECTRAL ASSYMMETRY INDEX (SASI)



$$SASI_{mn} = \frac{\sum_{f=F1}^{F2} S_{mn} - \sum_{f=F3}^{F4} S_{mn}}{\sum_{f=F1}^{F2} S_{mn} + \sum_{f=F3}^{F4} S_{mn}}$$

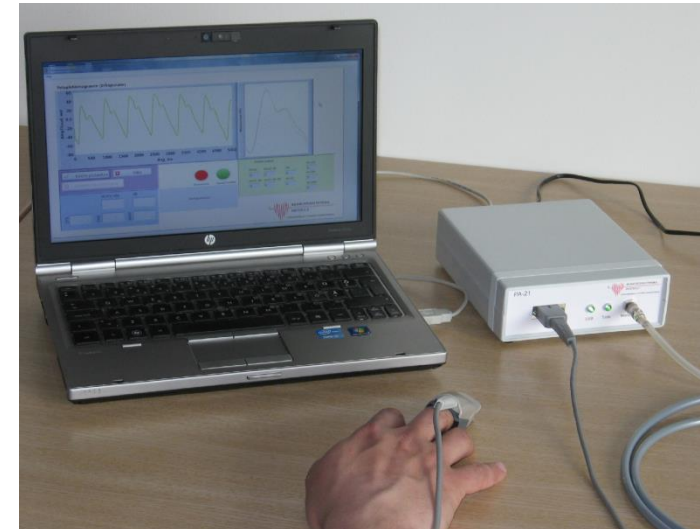
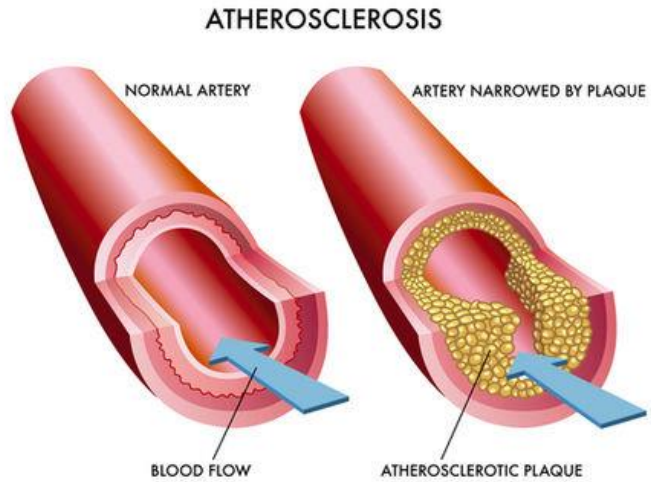


RESEARCH GROUPS

- Centre for Cardiovascular Medicine

Head - prof. Margus Viigimaa

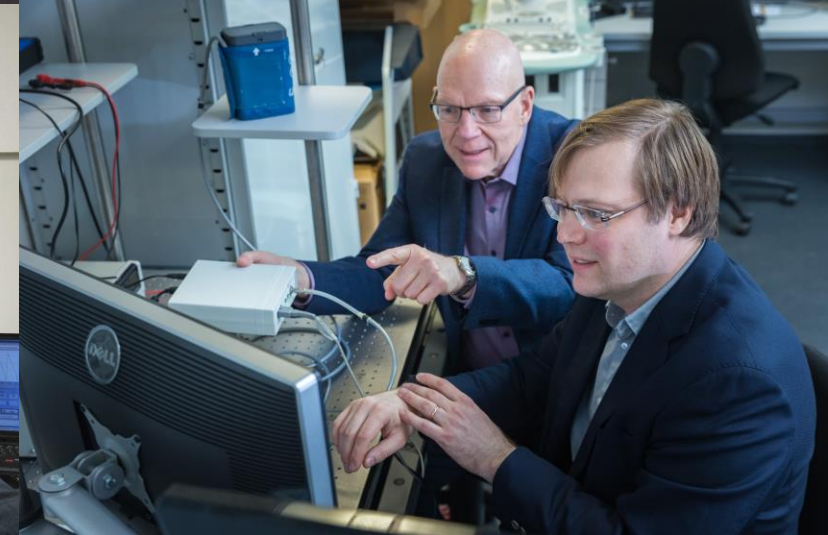
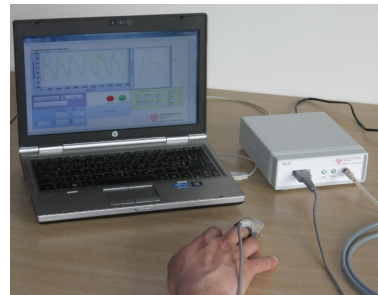
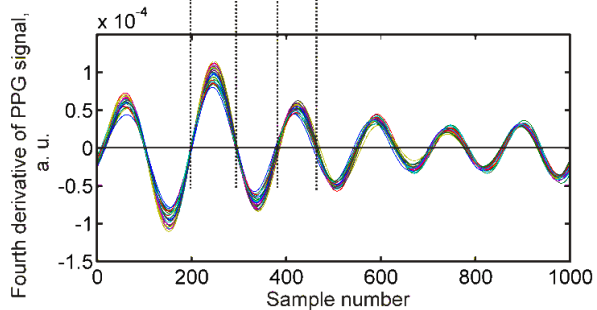
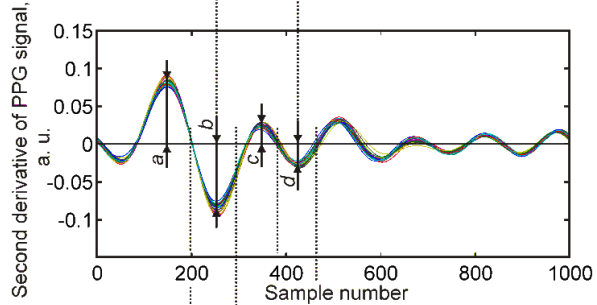
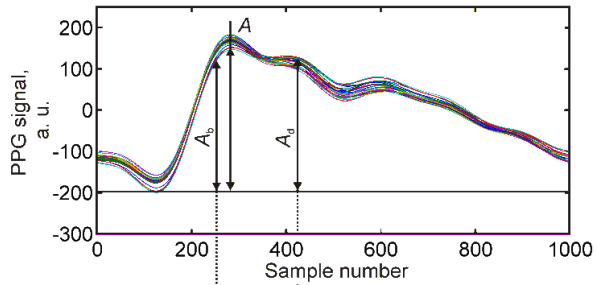
Hypertension, atherosclerosis, diabetes, cardiovascular risk, hypercholesterolemia, technologies for diagnosis



ESTIMATING THE AGE OF THE ARTERIES

The photoplethysmographic (PPG) signal and its processing allow the detection of arterial aging:

$$PPGAI = \frac{A_d}{A} = \frac{PPGd}{PPGb}$$



RESEARCH GROUPS



- **Centre for Digital Health**
Leads - prof. Peeter Ross, PhD Kadi Lubi

Digitization of healthcare, e-health, telemedicine, distance services, change management in healthcare

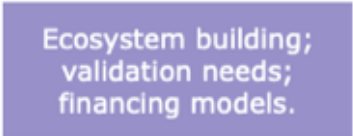
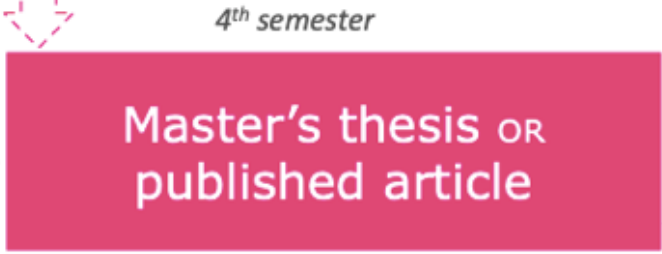
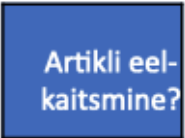
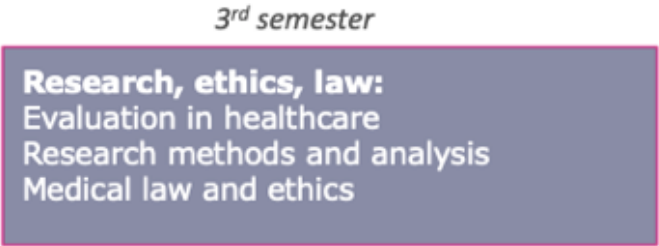
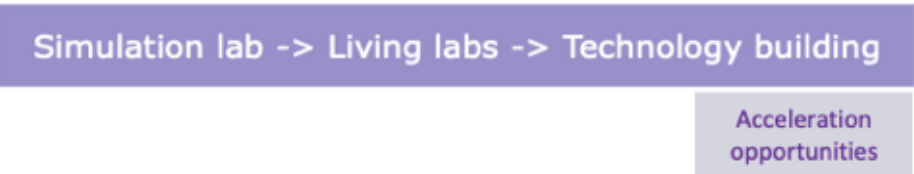
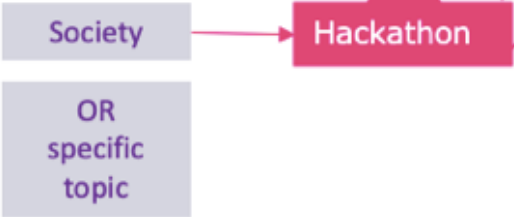
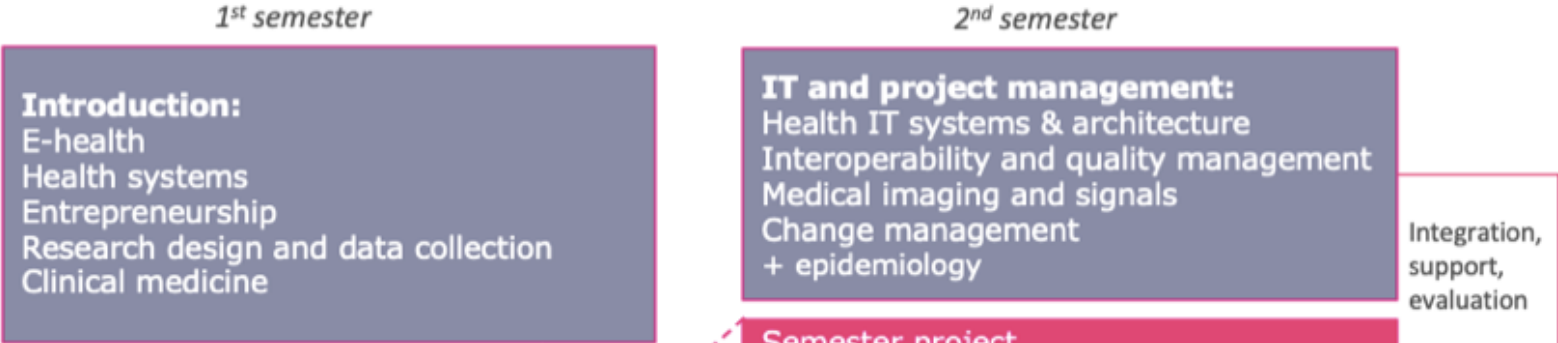
- Research in the areas of clinical decision support, evaluation of digital health technologies, online health data related behaviour, components and determinants of digitalisation of health care.
- Development of information technology solutions related to the digitalisation of healthcare
- IT solutions related to personal medicine, telemedicine, and distance services.
- Coordination of [Digital Health MSc programme](#) and the [PhD studies](#). Teaching digital literacy skills in healthcare.
- Implementing projects and custom orders, compiling project applications and tenders.
- Presentations and participation in various international research and development projects.

MEDICAL TECHNOLOGY AND MEDICAL PHYSICS MASTER CURRICULUM

- Programme is a combination of engineering, medicine, IT and physics
- Health care is constantly in the need for new technologies that help to improve the diagnosis and treatment processes. The biomedical engineers are coming from this curriculum
- Graduates of Medical Technology study programme might deal with functional diagnostics and take care of the equipment in intensive care or be responsible for the procurement, maintenance and safety of medical equipment in a hospital.
- In scientific research we cover the fields of biomedicine, neurology, nephrology and cardiovascular medicine.



Digital health (MSc)





TAL TECH



THANK YOU!

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<https://taltech.ee/en/department-health-technologies>