TERVISETEHNOLOOGIATE INSTITUUDI 2021 A ÜLEVAADE

Direktor: professor JANA HOLMAR, jana.holmar@taltech.ee, +372 620 2200

Instituudis tegutsevad järgmised uurimisrühmad:

- Aju bioelektriliste signaalide uurimisrühm. Juht: professor MAIE BACHMANN, maie.bachmann@taltech.ee
- E-tervise rakenduste ja teenuste uurimisgrupp. Juht: professor PEETER ROSS, peeter.ross@taltech.ee
- Hüpertensiooni ja ateroskleroosi diagnostika ning ravi tehnoloogiate uurimisgrupp. Juht: professor MARGUS VIIGIMAA, märgus.viigimaa@taltech.ee
- Sensortehnoloogiad meditsiinitehnikas. Juht: professor IVO FRIDOLIN, ivo.fridolin@taltech.ee

Instituudi 2021. a edulood

Sensortehnoloogiad meditsiinitehnikas, professor Ivo Fridolin

- Loodi uudne miniatuurne dialüüsi reaalajas jälgimise prototüüp (MCM sensor), mida testiti kliinilistes katsetes erinevates Euroopa kliinikutes;
- Pakuti välja uus meetod ja seade füüsilise väsimuse hindamiseks reaalajas füsioloogiliste signaalide ja parameetrite põhjal

Uurimisrühmade ülevaated

1. Aju bioelektriliste signaalide uurimisgrupp

Uurimisrühma juht: Maie Bachmann, professor, 620 2202, maie.bachmann@taltech.ee
Liikmed:
Hiie Hinrikus, vanemteadur, emeriitprofessor;
Jaanus Lass, vanemteadur;
Laura Päeske, teadur;
Tuuli Uudeberg, nooremteadur-doktorant;
Toomas Põld, doktorant.

Võtmesõnad: signaalitöötlus, elektroentsefalograafia, aju häired (sh. depressioon)

Kompetentsid

Uurimisgrupp omab kompetentsi interdistsiplinaarsel infotehnoloogia ja aju füsioloogia puutealal. Uuringud on suunatud aju elektroentsefalograafilises (EEG) signaalis mentaalsete häirete (sh. depressioon), tööstressi või keskkonna (mikrolainekiirgus) poolt tingitud muutuste avastamisele ja tõlgendamisele. Uurimisgrupi poolt väljatöötatud EEG spektraalse asümmeetria indeks (SASI) on tõestanud end kui perspektiivne meetod erinevates rakendustes.

Osalemine projektides

- TAR16013 (EXCITE) "IT Tippkeskus EXCITE (1.09.2016−1.03.2023)", PI M. Kruusmaa, Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Biorobootika keskus, Cybernetica AS;
- COST Action CA19127 *Cognitive decline in Nephro-Neurology: European Cooperative Target* (2020-2024);
- COST Action CA18106 *The neural architecture of consciousness* (2019-2023);
- 5GEMF1 "Hinnang praegustele ja 5G kasutuselevõtmisega kaasnevatele võimalikele tervisemõjudele, mis on seotud mitteioniseeriva kiirgusega“ (2021-2022), PI Maie Bachmann, Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Tervisetehnoloogiate instituut.

Teaduspublikatsioonid (valik)

- Põld, T. et al. (2021). Long-term stability of resting state EEG-based linear and nonlinear measures. International Journal of Psychophysiology, 159, 83−87. DOI: 10.1016/j.ijpsycho.2020.11.013.
- Hinrikus, H. et al. (2021). Threshold of radiofrequency electromagnetic field effect on human brain. International Journal of Radiation Biology, 97 (11), 1505−1515. DOI: 10.1080/09553002.2021.1969055.
- Pépin, M. et al. (2021). Cognitive disorders in patients with chronic kidney disease: specificities of clinical assessment. Nephrology Dialysis Transplantation. DOI: 10.1093/ndt/gfab262.

Tähtsamad tulemused

- Objektiivseid EEG signaalil põhinevaid mõõdikuid näitavad depressiooni varaseid sümptomeid;
- EEG signaalil põhinevate mõõdikute stabiilsus üle kolme aasta on kõrgeim lineaarsete ja mittelineaarsete meetodite puhul, mis kasutavad üht EEG kanalit ja sagedusriba, järgneb SASI, mis kasutab üht EEG kanalit ning kaht EEG sagedusriba.

AAK prioriteetsed suunad:

- Usaldusväärsed IT lahendused
- Tulevikku vaatav riigivalitsemine

Teadusvaldkond

1. Loodusteadused	1.2 Arvutiteadus ja informaatika
2. Tehnika ja tehnoloogia	2.6 Meditsiinitehnika

Teaduseriala

T115 Meditsiinitehnika
T121 Signaalitöötlus

Käimasolevate projektide/lepingute tulemusi saab rakendada:

- Tervishoius
- Tööohutuses
- Linnaplaneerimises

Brain bioelectrical signals research group

Group leader: Maie Bachmann, Professor, +372 620 2202, maie.bachmann@taltech.ee
Members:
Hiie Hinrikus, Senior Research Scientist, Professor Emeritus;
Jaanus Lass, Senior Research Scientist;
Laura Päeske, Researcher;
Tuuli Uudeberg, Early Stage Researcher, PhD student;
Toomas Põld, PhD student.

Key words: signal processing, electroencephalography, brain disorders (e.g. depression)

Competency

The research group is experienced in the interdisciplinary area of information technology and brain physiology. The studies are aimed to detect and interpret the features in the brain electroencephalography (EEG) signal characteristic for mental disorder (e.g. depression), occupational and/or environmental stressors comprising the advanced methods of signal analysis and the knowledge about brain neuronal activity. An original Spectral Asymmetry Index (SASI) has been developed and proved as a promising method in various applications.

Participation in the following significant projects

- TAR16013 (EXCITE) (TK148) "Estonian Centre of Excellence in ICT Research (1.09.2016−1.03.2023)", Maarja Kruusmaa, Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Biorobootika keskus, Cybernetica AS, (PI TTI I. Fridolin),
- COST Action CA19127 Cognitive decline in Nephro-Neurology: European Cooperative Target (2020-2024),
- COST Action CA18106 The neural architecture of consciousness (2019-2023),
- 5GEMF1 "Assessment of current and 5G caused possible health effects related to nonionizing radiation" (2021-2022).

Selected publications

- Põld, T. et al. (2021). Long-term stability of resting state EEG-based linear and nonlinear measures. International Journal of Psychophysiology, 159, 83−87. DOI: 10.1016/j.ijpsycho.2020.11.013.
- Hinrikus, H. et al. (2021). Threshold of radiofrequency electromagnetic field effect on human brain. International Journal of Radiation Biology, 97 (11), 1505−1515. DOI: 10.1080/09553002.2021.1969055.
- Pépin, M. et al. (2021). Cognitive disorders in patients with chronic kidney disease: specificities of clinical assessment. Nephrology Dialysis Transplantation. DOI: 10.1093/ndt/gfab262.

Main results

- by applying EEG-based objective measures it is feasible to indicate early symptoms of depression;
- the stability of the EEG-based measures over three years is the highest for the nonlinear and linear measures that use the signal from a single EEG channel and frequency band, followed by the SASI employing signals from a single channel and two frequency bands.

ASP priority areas:

- Dependable IT solutions

- Future governance

Field of research

1.2 Computer and information sciences
2.6 Medical engineering

T115 Medical technology
T121 Signal processing

2. Sensortehnoloogiad meditsiinitehnikas

Uurimisrühma juht: Ivo Fridolin, professor, 620 2206, Ivo.Fridolin@taltech.ee
Liikmed:
Kristjan Pilt, vanemteadur/Post-doc;
Jürgen Arund, vanemteadur;
Jana Holmar, vanemteadur;
Merike Luman, vanemteadur;
Risto Tanner, vanemteadur;
Nils Fredrik Arne Uhlin, vanemteadur;
Moonika Viigimäe, teadur;
Joosep Paats, doktorant-nooremteadur;
Ardo Allik, doktorant, insener;
Sandra Einstein, doktorant;
Andrus Paats, doktorant;
Deniss Karai, insener;
Rain Kattai, tehnik.

Võtmesõnad:
Sensorid, algoritmid, sensorite integratsioon, biovedelike optika, ureemilised toksiinid, dialüüsravi, reaalajas monitooring, spektrofotomeetria, spectrofluorimeetria, signaalitöötlus, tark töörõivas, füüsilise aktiivsuse monitooring, energiakulu, väsimuse monitooring, kõnetuvastus

Kompetents

Uurimisgrupi teadustöö eesmärgiks on välja töötada paindlikke ja uudseid sensortehnoloogiaid ja algoritme:

1. Ureemiliste toksiinide eemaldamise jälgimiseks reaalajas. Mõõdetud parameetrid võimaldavad hinnata erinevate ureemiliste toksiinide kontsentratsioone reaalajas ilma vereproove võtmata ning seega aitab saada paremini tagasisidet ravi (n neeruasendusravi) kohta ning kohandada raviviise vastavalt patsientide vajadustega.
2. Isikustatud ja targa töörõiva loomiseks, mis töörõivasse integreeritud sensorite ja uudsete algoritmide abil looks väärtuslikke andmeid tööliste asukohast, kõnnimustritest, füüsilisest aktiivsusest, energiakulust ja füsioloogilisest seisundist ning parandaks tehnoloogiliste lahenduste ja teenuste abil teadlikkust ja ohutust nõudlikes ja ohtlikes töökeskkondades.
3. Kõnetuvastuse rakendusteks meditsiinis ja tööstuses.
4. Uuenduslike psühhofüsioloogiliste meetodite väljatöötamine, mis ühendab kvantitatiivseid füsioloogilisi ja subjektiivseid psühholoogilisi näitajaid, et hinnata inimeste emotsionaalset vastust erinevatele (elu)keskkondadele (n turvalised, mugavad, stressirohked, ülestimuleerivad või ebaatraktiivsed). Üks rakendusvaldkond on ületada lõhe linnaplaneerijate ja linnaelanike vahel kasutades nn heaoluskoori kaardistamist.

Osalemine projektides

- TAR16013 (EXCITE) "IT Tippkeskus EXCITE (1.09.2016−1.03.2023)", Maarja Kruusmaa, Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Biorobootika keskus, Cybernetica AS, (PI TTI I. Fridolin);
- Online Dialysis Sensor Pilot Study, contract research, Optofluid Technologies OÜ and Fresenius Medical Care Deutschland GmbH, 2021;
- PUTJD815 "Uue optilise sensori arendamine vastsündinute tserebrospinaalvedeliku pulsatsioonide pidevaks jälgimiseks hüdrotsefaalia korral (1.12.2019−30.11.2021)", Kristjan Pilt, Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Tervisetehnoloogiate instituut.

Teaduspublikatsioonid (valik)

- Vlahou, A., D. Hallinan, R. Apweiler, A. Argiles, J. Beige, A. Benigni, R. Bischoff, P. C. Black, F. Boehm, J. Céraline, G. P. Chrousos, C. Delles, P. Evenepoel, I. Fridolin, G. Glorieux, A. J. v. Gool, I. Heidegger, J. P.

A. Ioannidis, J. Jankowski, V. Jankowski, C. Jeronimo, A. M. Kamat, R. Masereeuw, G. Mayer, H. Mischak, A. Ortiz, G. Remuzzi, P. Rossing, J. P. Schanstra, B. J. Schmitz-Dräger, G. Spasovski, J. A. Staessen, D. Stamatialis, P. Stenvinkel, C. Wanner, S. B. Williams, F. Zannad, C. Zoccali and R. Vanholder (2021). " Data Sharing Under the General Data Protection Regulation." Hypertension 77(4): 1029-1035. https://doi.org/10.1161/HYPERTENSIONAHA.120.16340.

- Paats, Joosep; Adoberg, Annika; Arund, Jürgen; Fridolin, Ivo; Lauri, Kai; Leis, Liisi; Luman, Merike; Tanner, Risto. 2021. "Optical Method and Biochemical Source for the Assessment of the Middle-Molecule Uremic Toxin β2-Microglobulin in Spent Dialysate" Toxins 13, no. 4: 255. https://doi.org/10.3390/toxins13040255.
- Kööts, K.; Pilt, K.; Sepa, M.; Pikta, M.; Fridolin, I.; Meigas, K.; Viigimaa, M. (2021). Assessment of Associations Between Arterial Mechanical Properties and Biochemical Blood Markers for Early Detection of Atherosclerosis. In: 8th European Medical and Biological Engineering Conference (121−129). Springer, Cham. (IFMBE Proceedings; 80). DOI: 10.1007/978-3-030-64610-3_15.

Patendid ja patenditaotlused

- Patentne leiutis: Multiparameetriline optiline meetod ja seade ureemiliste soluutide, sh ureemiliste toksiinide määramiseks bioloogilistes vedelikes; Omanikud: Tallinna Tehnikaülikool; Autorid: Ivo Fridolin, Risto Tanner, Jürgen Arund, Joosep Paats; Prioriteedi number: GB2104698.2; Prioriteedi kuupäev: 31.03.2021.
- Patentne leiutis: Meetod ja seade füüsilise väsimuse oleku hindamiseks reaalajas füsioloogiliste signaalide ja parameetrite põhjal; Omanikud: Tallinna Tehnikaülikool; Autorid: Ardo Allik, Kristjan Pilt, Moonika Viigimäe, Ivo Fridolin, Gert Jervan; Prioriteedi number: P202100009; Prioriteedi kuupäev: 10.03.2021.

Uurimisrühma viimaste aastate rahvusvahelisel tasemel väljapaistvad teadustulemused

- Loodi uudne miniatuurne dialüüsi reaalajas jälgimise prototüüp (MCM sensor), mida testiti kliinilistes katsetes erinevates Euroopa kliinikutes;
- Pakuti välja uus meetod ja seade füüsilise väsimuse hindamiseks reaalajas füsioloogiliste signaalide ja parameetrite põhjal.

AAK prioriteetsed suunad:

- Usaldusväärsed IT lahendused
- Tulevikku vaatav riigivalitsemine

Tegevusvaldkond

1. Loodusteadused	1.2 Arvutiteadus ja informaatika
2. Tehnika ja tehnoloogia	2.6 Meditsiinitehnika

Teaduseriala

T115 Meditsiinitehnika
T121 Signaalitöötlus

Tunnustused

- Tallinna Tehnikaülikooli Tervisetehnoloogiate instituudi biomeditsiinitehnika keskuse vanemteadur ja Põhja-Eesti Regionaalhaigla nefroloog Dr Merike Luman sai 2021. aastal Eesti Vabariigi presidendilt Eesti Punase Risti III klassi teenetemärgi;
- J. Paatsi magistritöö “Trüptofaani ja trüptofaani metaboliitide tasemed ja eemaldamine kroonilise neerupuudulikkusega patsientidel hemodialüüsravi käigus” (juh J. Arund, kaasjuh. I. Fridolin), saavutas Haridus- ja Teadusministeeriumi 2020. a üliõpilaste teadustööde riikliku konkursil arsti- ja terviseteaduste valdkonna I preemia magistriõppe astmes;

- Prof I. Fridolin, Invited lecture „Intradialytic multicomponent uremic toxins monitoring - a step closer to the smartificial renal replacement therapy“ and a discussion at Fresenius Medical Care Deutschland GmbH Science Forum on June 29th, 2021;
- Prof I. Fridolin, Invited lecture „Spectrophotometric eyes for artificial kidney performance monitoring“ and panel discussion „Discussion:Speeding up Implementation:from Idea to Implementation through regulation“ at „Life Sciences Baltics 2021“ conference (https://lifesciencesbaltics.com), September 22-23, 2021.

Osalus oluliste TA&I-ga seotud välisorganisatsioonide töös:

I. Fridolin on rahvusvahelise European Uremic Toxin Work Group (EUTox WG) liige.

Uurimisrühma senised rakendused ettevõtluses, majanduses, ühiskonnas

- European Union through the European Regional Development Fund H2020-SMEINST-2-2017, OLDIAS2—Online Dialysis Sensor Phase2 project, Grant Agreement nr 767572. (2017-2019);
- Online Dialysis Sensor Pilot Study, contract research, Optofluid Technologies OÜ and Fresenius Medical Care Deutschland GmbH, 2021.

Käimasolevate projektide/lepingute tulemusi saab rakendada:

- Tervishoius
- Tööohutuses
- Linnaplaneerimises

Sensor technologies in biomedical engineering (SensorTechBME) research group

Group leader: Ivo Fridolin, Professor, +372 620 2206 ivo.fridolin@taltech.ee
Members:
Kristjan Pilt, Senior Research Scientist, **Post-doc**;
Jürgen Arund, Senior Research Scientist;
Jana Holmar, Senior Research Scientist;
Merike Luman, Senior Research Scientist;
Risto Tanner, Senior Research Scientist;
Nils Fredrik Arne Uhlin, Senior Research Scientist;
Moonika Viigimäe, Researcher;
Joosep Paats, Early Stage Researcher;
Ardo Allik, Engineer, PhD student;
Sandra Einstein, PhD student;
Andrus Paats, PhD student;
Deniss Karai, Engineer;
Rain Kattai, Technician.

Key words: Sensors, algorithms, sensor fusion, biofluid optics, uremic toxins, dialysis, on-line monitoring, spectrophotometry, spectrofluorimetry, signal processing, smart work wear, physical activity monitoring, energy consumption, fatigue monitoring, automatic speech recognition, speech-to-text applications

Competency

The main research field of the SensorTechBME team is to develop flexible and novel sensor technologies and algorithms in biomedical engineering applications:

1. to estimate dialysis adequacy and quality securing end stage renal disease (ESRD) patients’ care quality. The research is exploring spectrophotometrical and spectrofluorimetrical characteristics-signatures of the biofluids and performing various signal processing and analysis on those signals;

2. to develop beyond the state-of-the-art applications incorporated into a smart wearable multi-sensor fusion system for generating valuable data about the workers' location, locomotion, physical activity, energy consumption and physiological status;
3. for speech-to-text usage in healthcare and industry;
4. The **well-being score** is an innovative method and tool integrating quantitative physiological and subjective psychological indicators for assessing environments that are not only safe and convenient, but also interesting or pleasant or vice versa to define environments that are unsafe, stressful, overstimulating, or unattractive. One application area of the tool is to bridge the gap between urban planners and urban residents utilizing a well-being score mapping.

Participation in the following significant projects

- Estonian Centre of Excellence in ICT Research EXCITE (PI for Dept. of Healthcare Tech I. Fridolin);
- Online Dialysis Sensor Pilot Study, contract research, Optofluid Technologies OÜ and Fresenius Medical Care Deutschland GmbH, 2021;
- PUTJD815 "A new optical sensor development for online monitoring of cerebrospinal fluid pulsations in neonatal hydrocephalus" (1.12.2019−30.11.2021); Principal Investigator: Kristjan Pilt; Tallinn University of Technology, School of Information Technologies, Department of Health Technologies.

Selected Publications

- Vlahou, A., D. Hallinan, R. Apweiler, A. Argiles, J. Beige, A. Benigni, R. Bischoff, P. C. Black, F. Boehm, J. Céraline, G. P. Chrousos, C. Delles, P. Evenepoel, I. Fridolin, G. Glorieux, A. J. v. Gool, I. Heidegger, J. P. A. Ioannidis, J. Jankowski, V. Jankowski, C. Jeronimo, A. M. Kamat, R. Masereeuw, G. Mayer, H. Mischak, A. Ortiz, G. Remuzzi, P. Rossing, J. P. Schanstra, B. J. Schmitz-Dräger, G. Spasovski, J. A. Staessen, D. Stamatialis, P. Stenvinkel, C. Wanner, S. B. Williams, F. Zannad, C. Zoccali and R. Vanholder (2021). " Data Sharing Under the General Data Protection Regulation." Hypertension 77(4): 1029-1035. https://doi.org/10.1161/HYPERTENSIONAHA.120.16340.
- Paats, Joosep; Adoberg, Annika; Arund, Jürgen; Fridolin, Ivo; Lauri, Kai; Leis, Liisi; Luman, Merike; Tanner, Risto. 2021. "Optical Method and Biochemical Source for the Assessment of the Middle-Molecule Uremic Toxin β2-Microglobulin in Spent Dialysate" Toxins 13, no. 4: 255. https://doi.org/10.3390/toxins13040255.
- Kööts, K.; Pilt, K.; Sepa, M.; Pikta, M.; Fridolin, I.; Meigas, K.; Viigimaa, M. (2021). Assessment of Associations Between Arterial Mechanical Properties and Biochemical Blood Markers for Early Detection of Atherosclerosis. In: 8th European Medical and Biological Engineering Conference (121−129). Springer, Cham. (IFMBE Proceedings; 80). DOI: 10.1007/978-3-030-64610-3_15.

Patents and patent applications

- Invention: Method and a device for quantitative concentration measurements of protein bound and middle sized uremic toxins and advanced glycation end-products in the biological fluids; Owners: Tallinn University of Technology; Authors: Ivo Fridolin, Risto Tanner, Jürgen Arund, Joosep Paats; Priority number: GB2104698.2; Priority date: 31.03.2021.
- Invention: Method and Device for Real-time Physical Fatigue Estimation Based on Physiological Signals and Parameters; Owners: Tallinn University of Technology; Authors: Ardo Allik, Kristjan Pilt, Moonika Viigimäe, Ivo Fridolin, Gert Jervan; Priority number: P202100009; Priority date: 10.03.2021.

Affiliation of the research team to the TalTech Academic Development Plan priority areas

- Health
- Computer and information sciences
- Natural Sciences

Field of research

1. Natural Sciences 1.2 Computer and information sciences

2. Engineering and technology 2.6 Medical engineering

T115 Medical technology T121 Signal processing

Outstanding research results

- A new a novel on-line multicomponent miniaturized optical sensor for monitoring removal of uremic toxins in the spent dialysate during hemodialysis was designed and validated in an European multicenter clinical study;
- A new method and device were developed for real-time physical fatigue estimation based on physiological signals and parameters.

Honours/awards of the research group members at national/international level for the past year.

- Dr. Merike Luman, a senior research scientist at the Biomedical Engineering Centre of the Department of Health Technologies of Tallinn University of Technology and a nephrologist at the North Estonia Medical Centre, received the Order of the Estonian Red Cross, 2nd Class from the president of the Republic of Estonia;
- J. Paats' master's thesis „Levels and removal of tryptophan and tryptophan derivatives in chronic kidney failure patients, effect of dialysis machine settings.“(supervisor Jürgen Arund, co-supervisor Ivo Fridolin), won the 1st prize in the field of medical and health sciences in The Ministry of Education and Research national competition for student research in 2020;
- Prof I. Fridolin, Invited lecture „Intradialytic multicomponent uremic toxins monitoring - a step closer to the smartificial renal replacement therapy“ and a discussion at Fresenius Medical Care Deutschland GmbH Science Forum on June 29th, 2021;
- Prof I. Fridolin, Invited lecture „Spectrophotometric eyes for artificial kidney performance monitoring“ and panel discussion „Discussion: Speeding up Implementation: from Idea to Implementation through regulation“ at „Life Sciences Baltics 2021“ conference (https://lifesciencesbaltics.com), September 22-23, 2021.

Organizational activity

I. Fridolin is a member of the international European Uremic Toxin Work Group (EUTox WG).

Information of applications in business, economics, society

- European Union through the European Regional Development Fund H2020-SMEINST-2-2017, OLDIAS2—Online Dialysis Sensor Phase2 project, Grant Agreement nr 767572. (2017-2019);
- Online Dialysis Sensor Pilot Study, contract research, Optofluid Technologies OÜ and Fresenius Medical Care Deutschland GmbH, 2021.

The results of ongoing projects/contracts can be applied

- Healthcare
- Work safety
- Urban Planning

3. Hüpertensiooni ja ateroskleroosi diagnostika ning ravi tehnoloogiate uurimisgrupp

Uurimisrühma juht: Margus Viigimaa, professor, margus.viigimaa@taltech.ee
Liikmed:
Kalju Meigas, emeriitprofessor;
Sergei Nazarenko, praktik-professor;
Tiina Titma, teadur;
Juhan Reimand, doktorant;
Grete Talviste, doktorant.

Võtmesõnad: hüpertensioon, ateroskleroos, tehnoloogiad, diagnoosimine, ravi, patsiendiohutus

Kompetents

- Südame- ja veresoonte haiguste diagnostika ja ravi tehnoloogiate uurimine ja rakendamine;
- südame - veresoonkonna haigustega seotud teaduslikes uuringutes kasutatavate insenerilahenduste juurutamine meditsiini;
- uute kardiovaskulaarmeditsiini tehnoloogiate väljatöötamine ja kliiniline rakendamine;
- varajase ateroskleroosi määramise uuringud ja seadmete juurutamine;
- resistentse hüpertensiooni hemodünaamika uuringud ja innovatiivsete ravijuhtimise meetodite väljatöötamine;
- kardiovaskulaarse riski (koos geeniriskiga) määramise ja langetamise uuringud;
- perekondliku hüperkolesteroleemia diagnoosimise ja ravi uuringud;
- meditsiinikiirituse audit.

Osalemine projektides

Uurimisrühm osaleb TalTechi ning SA Põhja-Eesti Regionaalhaigla vahel sõlmitud projektis „Perekondliku hüperkolesteroleemia diagnoosimise ja ravi uute tehnoloogiate väljatöötamine“. Uurimistöö on suunatud perekondliku hüperkolesteroleemia patsientide arterite ateroskleerotiliste muutuste mitteinvasiivsele diagnoosimise ja uute ravimeetodite kliiniline rakendamisele.
Personaalmeditsiini kliinilises juhtprojektis südame-veresoonkonna haiguste täppisennetuses (RITA1/01-42) uuritakse personaalmeditsiini rakendatavust südame-veresoonkonna haiguste preventsioonis. Projekti juht on professor M. Viigimaa.

Teaduspublikatsioonid (valik)

- Pikta M, Szanto T, Viigimaa M, Lejniece S, Balode D, Saks K, Banys V. Evaluation of a new semi-automated Hydragel 11 von Willebrand factor multimers assay kit for routine use. Journal of Medical Biochemistry 2021, 40 (2), 167−172. DOI: 10.5937/jomb0-26008.
- Weber T, Januszewicz A, Rosei EA, Tsioufis K, Viigimaa M, et al. The corona-virus disease 2019 pandemic compromised routine care for hypertension: a survey conducted among excellence centers of the European Society of Hypertension. JOURNAL OF HYPERTENSION 2021, 39 (1), 190−195. DOI: 10.1097/HJH.0000000000002703.
- Schwartz GG, Szarek M, Bittner VA, Diaz R, Viigimaa M, et al. Lipoprotein(a) and Benefit of PCSK9 Inhibition in Patients With Nominally Controlled LDL Cholesterol. Journal of the American College of Cardiology 2021, 78 (5), 421−433. DOI: 10.1016/j.jacc.2021.04.102.
- Kööts K, Pilt K, Sepa M, Pikta M, Fridolin I, Meigas K, Viigimaa M. Assessment of Associations Between Arterial Mechanical Properties and Biochemical Blood Markers for Early Detection of Atherosclerosis. In: 8th European Medical and Biological Engineering Conference 2021(121−129). Springer, Cham. (IFMBE Proceedings; 80). DOI: 10.1007/978-3-030-64610-3_15.
- Visseren FLJ, Mach F, Smulders YM, Carballo D, Viigimaa M, et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice. ESC National Cardiac Societies; ESC Scientific Document Group. Eur Heart J. 2021 Sep 7;42(34):3227-3337. doi: 10.1093/eurheartj/ehab484
- EAS Familial Hypercholesterolaemia Studies Collaboration (incl. Viigimaa M). Global perspective of familial hypercholesterolaemia: a cross-sectional study from the EAS Familial Hypercholesterolaemia Studies Collaboration (FHSC). Lancet. 2021 Nov 6;398(10312):1713-1725. doi: 10.1016/S0140-6736(21)01122-3.

- Alev K, Kütt A, Viigimaa M: Disclosing Pharmacogenetic Feedback of Caffeine via eHealthChannels, Assessment of the Methods and Effects to Behavior Change: A Pilot Study. Front Digit Health. 2021 Feb 9;2:567656. doi: 10.3389/fdgth.2020.567656.
- Parm Ü, Tamm AL, Laugamets A, Viigimaa M. The Impact of Marathons on the Recovery of Heart Rate and Blood Pressure in Non-Professional Male Marathoners' (≥45 Years). Medicina (Kaunas). 2021 Dec 9;57(12):1346. doi: 10.3390/medicina57121346.
- Moreira AP, Jamar F, Ozcan Z, Piciu D, Nazarenko S, et al. Impact of the COVID-19 pandemic on nuclear medicine departments in Europe. Eur J Nucl Med Mol Imaging 2021; Oct;48(11):3361-3364. doi: 10.1007/s00259-021-05484-z.

Rahvusvahelisel tasemel väljapaistvad teadustulemused

Uurimisrühm osaleb European Atherosclerosis Society Familial Hypercholesterolaemia Studies Collaboration (FHSC). Osalesime 2021.a. publikatsioonis “A cross-sectional study from the EAS Familial Hypercholesterolaemia Studies Collaboration! ajakirjas Lancet. Uurimisrühm kuulub ka Euroopa Hüpertensiooniühingu Ektsellentsikeskuse hulka. Avaldasime 2021.a. artikli “Corona-virus disease 2019 pandemic compromised routine care for hypertension”.
Kõrgetasemeliste publikatsioonide (1.1.) arv aastal 2020 on 13.

Tegevusvaldkond

3.2. Kliiniline meditsiin
3.3. Terviseteadused

Teaduseriala

B530 Südame-veresoonkonna haigused

Research group on diagnostics and treatment technologies of hypertension and atherosclerosis

Group leader: Margus Viigimaa, Professor, margus.viigimaa@taltech.ee
Members:
Kalju Meigas, Professor Emeritus;
Sergei Nazarenko, Professor of Practice;
Tiina Titma, Researcher;
Juhan Reimand, PhD student.
Grete Talviste, PhD student.

Key words: hypertension, atherosclerosis, technologies, diagnosis, treatment, patient safety

Competency

- Research and development of novel technologies in cardiovascular medicine.
- Development of the cardiovascular medical engineering.
- Clinical application of novel technologies in the field of cardiovascular medicine.
- Early atherosclerosis and development of novel technologies and devices.
- Hemodynamics of resistant hypertension and development of novel methods in guiding of drug treatment.
- Cardiovascular risk assessment (including polygenic risk score) and management.
- Diagnosis and treatment of familial hypercholesterolemia.
- Medical radiation audit.

Participation in the following significant projects

The group members participate in the joint research project with the North Estonia Medical Centre “Novel technologies in the diagnostics and treatment of familial hypercholesterolemia”.

In the RITA1/01-42-02 "Clinical pilot projects of personalised medicine in the precise prevention of breast cancer and cardiovascular diseases (2018−2020)" personalised medicine in cardiovascular primary prevention is studied.

Selected publications

- Pikta M, Szanto T, Viigimaa M, Lejniece S, Balode D, Saks K, Banys V. Evaluation of a new semi-automated Hydragel 11 von Willebrand factor multimers assay kit for routine use. Journal of Medical Biochemistry 2021, 40 (2), 167−172. DOI: 10.5937/jomb0-26008.
- Weber T, Januszewicz A, Rosei EA, Tsioufis K, Viigimaa M, et al. The corona-virus disease 2019 pandemic compromised routine care for hypertension: a survey conducted among excellence centers of the European Society of Hypertension. JOURNAL OF HYPERTENSION 2021, 39 (1), 190−195. DOI: 10.1097/HJH.0000000000002703.
- Schwartz GG, Szarek M, Bittner VA, Diaz R, Viigimaa M, et al. Lipoprotein(a) and Benefit of PCSK9 Inhibition in Patients With Nominally Controlled LDL Cholesterol. Journal of the American College of Cardiology 2021, 78 (5), 421−433. DOI: 10.1016/j.jacc.2021.04.102.
- Kööts K, Pilt K, Sepa M, Pikta M, Fridolin I, Meigas K, Viigimaa M. Assessment of Associations Between Arterial Mechanical Properties and Biochemical Blood Markers for Early Detection of Atherosclerosis. In: 8th European Medical and Biological Engineering Conference 2021(121−129). Springer, Cham. (IFMBE Proceedings; 80). DOI: 10.1007/978-3-030-64610-3_15.
- Visseren FLJ, Mach F, Smulders YM, Carballo D, Viigimaa M, et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice. ESC National Cardiac Societies; ESC Scientific Document Group. Eur Heart J. 2021 Sep 7;42(34):3227-3337. doi: 10.1093/eurheartj/ehab484.
- EAS Familial Hypercholesterolaemia Studies Collaboration (incl. Viigimaa M). Global perspective of familial hypercholesterolaemia: a cross-sectional study from the EAS Familial Hypercholesterolaemia Studies Collaboration (FHSC). Lancet. 2021 Nov 6;398(10312):1713-1725. doi: 10.1016/S0140-6736(21)01122-3.
- Alev K, Kütt A, Viigimaa M: Disclosing Pharmacogenetic Feedback of Caffeine via eHealthChannels, Assessment of the Methods and Effects to Behavior Change: A Pilot Study. Front Digit Health. 2021 Feb 9;2:567656. doi: 10.3389/fdgth.2020.567656.
- Parm Ü, Tamm AL, Laugamets A, Viigimaa M. The Impact of Marathons on the Recovery of Heart Rate and Blood Pressure in Non-Professional Male Marathoners' (≥45 Years). Medicina (Kaunas). 2021 Dec 9;57(12):1346. doi: 10.3390/medicina57121346.
- Moreira AP, Jamar F, Ozcan Z, Piciu D, Nazarenko S, et al. Impact of the COVID-19 pandemic on nuclear medicine departments in Europe. Eur J Nucl Med Mol Imaging 2021; Oct;48(11):3361-3364. doi: 10.1007/s00259-021-05484-z.

Internationally recognised research results

The group is participating in the European Atherosclerosis Society Familial Hypercholesterolaemia Studies Collaboration (FHSC). A cross-sectional study from the EAS Familial Hypercholesterolaemia Studies Collaboration was published in the Lancet. The group is also among the Excellence centers of the European Society of Hypertension. The paper about the corona-virus disease 2019 pandemic compromised routine care for hypertension was published in 2021.

The number of 1.1. publications in 2021 is 13.

Fields of research

3.2 Clinical medicine
3.3 Health sciences

B530 – Cardiovascular system

4. E-tervise rakenduste ja teenuste uurimisgrupp

Uurimisrühma juht: Peeter Ross, professor, tel 5635 3460 peeter.ross@taltech.ee
Liikmed:
Katrin Gross-Paju, vanemteadur;
Madis Tiik, vanemlektor;
Riina Hallik, lektor;
Hany Gergis Moawad Mina, lektor;
Priit Kruus, lektor, doktorant;
Igor Bossenko, doktorant-nooremteadur;
Kristian Juha Ismo Kankiainen, doktorant-nooremteadur;
Marten Kask, doktorant-nooremteadur;
Toomas Klementi, doktorant-nooremteadur;
Olga Vovk, doktorant-nooremteadur;
Markus Bertl, doktorant;
Riin Ehin, doktorant
Janek Metsallik, e-tervise spetsialist, doktorant;
Maarja-Liis Elland, e-tervise analüütik;
Barbara Haage, projektijuht;
Liis Hamburg, projektijuht;
Maarja Kuslapuu, projektijuht;
Kadi Lubi, tervishoiu spetsialist;
Kerli Luks, tervishoiu spetsialist;
Mall Maasik, projektijuht;
Kerli Metsla, projektijuht;
Helen Staak, õppekava kommunikatsiooni spetsialist.

Võtmesõnad: Tervishoiu digitaliseerimine, digitervis, muutuste juhtimine tervishoius, e-tervis, digitaalsete tervisetehnoloogiate hindamine

Kompetents

2021. aastal oli uurimisrühma spetsiifilisem tegevus seotud meditsiinis ja tervishoius kasutatavate digitaalsete andmete kvaliteedi, arhitektuuri ja andmemudelitega, digitaalsete tervisetehnoloogiate hindamise ja kasutusvaldkondadega ning digitervise lahenduste õpetamisega arstidele ja õdedele. Samuti jätkus personaalmeditsiiniga seonduvate infotehnoloogiliste lahenduste uurimine.

Keskuse põhitegevused

Uurimistöö tegemine valdkondades, mis käsitlevad terviseandmete mudeleid, kliinilisi otsustustugesid, digitaalsete tervisetehnoloogiate hindamist, inimese terviseandmetega seonduvat käitumist veebis ning tervishoiu digitaliseerimise komponente ja tegureid. Osalemine ja ettekanded erinevates rahvusvahelistes teadus- ja arendusprojektides.
Health Care Technology magistriprogrammi õppe läbiviimine, projektide ja tellimustööde teostamine ning projektitaotluste ja pakkumuste kirjutamine.
2021. aastal toimus keskuse teadustöö järgmiste projektide või tellimustööde raames:

- Digitervise lahenduste tasustamist toetav raamistik ja ettepanekud (Eesti Haigekassa);
- “Katkematu raviteekonna loomine insuldi läbi teinud inimestele” (Eesti Haigekassa);
- Perearstide digitaalse kirjaoskuse tõstmise koolitus (Majandus- ja Kommunikatsiooniministeerium);
- 7 doktorandi uurimisteemad digitervise erinevates valdkondades.

Osalemine projektides

- Perearstide digitaalse kirjaoskuse tõstmise koolitus;
- HealthSense. Universaalse andmemudeli ja raviteekondade järjepidevuse standardi väljatöötamine lähtudes rahvusvahelistest uue põlvkonna terviseinfosüsteemide standarditest Norway Grants Programme "Green ICT"(Norway Grants Programme “Green ICT”);
- Kaugteenuste näidisprojektide protsessi analüüs Eesti Haigekassale (Eesti Haigekassa);

- Doktorant Priit Kruus'i uurimisteema teledermatoskoopiast;
- NORDeHEALTH Põhjamaade e-tervis patsientidele: võrdlusuuringud ja arendustööd tulevikuks (Eesti Teadusagentuur).

Olulisemad artiklid:

- Boyko, A.; Therapontos, C.; Horakova, D.; Szilasiová, J.; Kalniņa, J.; Kolontareva, J.; Gross-Paju, K.; Selmaj, K.; Sereike, I.; Milo, R.; Gabelić, T.; Rot, U. (2021). Approaches and challenges in the diagnosis and management of secondary progressive multiple sclerosis: A Central Eastern European perspective from healthcare professionals. Multiple Sclerosis and Related Disorders, 50, #102778. DOI: 10.1016/j.msard.2021.102778.
- Laissaar, M.; Hallik, R.; Sillaste, P.; Ragun, U.; Pärn, M.-L.; Suija, K. (2021). Translation and cultural adaptation of IPOS (integrated palliative care outcome scale) in Estonia. Journal of Patient-reported Outcomes, 5 (1), #15. DOI: 10.1186/s41687-021-00288-z.

Magistriprogrammi planeerimine ja koordineerimine ning magistritööde juhendamine kulges hästi. Programmi juhtimise võttis Priit Kruusilt üle Kadi Lubi. Endiselt on õppesse soovijate hulk suurem, kui planeeritud 25 kohta, mis tähendab, et huvi tervishoiutehnoloogiat õppida on noortel olemas. E-meditsiini keskuses tegelesid oma teadustööga 2021. aastal 8 doktoranti, kellele lisandus Priit Kruus.
Meie keskuse töötajad olid rahvusvaheliselt aktiivsed: erinevatel veebivahendusel läbi viidud üritustel tehti mitukümmend ettekannet. Meil on koostöö Põhjamaade ülikoolidega, Kyoto Ülikooliga Jaapanist, mitme Soome teadus- ja arendusasutusega, Flensburgi ja Regensburgi rakenduskõrgkooliga ning paljude teistega. Samuti on meil tihe koostöö Eesti digitervise valdkonna iduettevõtetega, ITK, LTKH, PERH-i, Haigekassa, TEHIK-u, Geenivaramu ja IT ettevõtetega.
E-meditsiini keskusesse lisandus 2021. aastal 1 doktorant ja mitu akadeemilist töötajat ning sisuliselt on akadeemilisel tööl 20 inimest. Lisaks oli meie vastutusel oleva 12 õppeaine läbi viimiseks käsunduslepingud paljude (ligi 20) spetsialistidega.
Keskuse õppe-, arendus- ja teadustöö toimub väga huvitavas valdkonnas – digitervis/e-tervis – mis on käesoleval ajal aktuaalne valdkond kogu maailmas. See annab positiivse tausta meie keskuse töötajatele. E-meditsiini keskuse eelarve eelmisel aastal kahekordistus peamiselt uute projektide arvel üle 500 tuhande euroni, millest ligikaudu üks kolmandik laekub õppetööks mõeldud eraldisest. Üksnes õppejõudude kulu on ligi 150 tuhat eurot aastas. Õppetööga paralleelselt valdkonna ettevõtetes töötamine annab väga palju juurde õpetamise sisule ja võimaldab õpetada reaalselt elus vaja minevaid oskusi.

Uurimisrühma seotus AAK prioriteetse suunaga:

- Usaldusväärsed IT-lahendused
- Tulevikku vaatava riigivalitsemine

Tegevusvaldkond

3. Arsti- ja terviseteadused	3.3 Terviseteadused
3. Arsti- ja terviseteadused	3.4 Meditsiiniline biotehnoloogia

Teaduseriala

T115 Meditsiinitehnika

Osalemine oluliste TA&I-ga seotud välisorganisatsioonide töös

Kaks keskuse töötajat on Maailmapanga ning üks Aasia Arengupanga ja Saksa Arengupanga KfW konsultandid digitervise valdkonnas.

Info uurimisrühma rakendusliku väljundiga teadus- ja arendustegevuses

E-meditsiini keskus on saanud rahastuse järgmiseks 2 aastaks kahele rahvusvahelisele projektile:

- HealthSense. In cooperation with Health and Welfare Information System Center and Software Technology and Applications Competence Centre (STACC).
- Nordic eHealth for Patients: Benchmarking and Developing for the Future (NordForsk). The consortium includes 4 universities from Sweden and 1 university from Finland, Norway and USA.

Digital health applications and services

Group leader: Peeter Ross, Professor, +372 5635 3460 peeter.ross@taltech.ee
Members:
Katrin Gross-Paju, Senior Research Scientist;
Madis Tiik, Senior Lecturer;
Riina Hallik, Lecturer;
Hany Gergis Moawad Mina Lecturer;
Priit Kruus, Lecturer, PhD student;
Igor Bossenko, Early Stage Researcher;
Kristian Juha Ismo Kankiainen, Early Stage Researcher;
Marten Kask, Early Stage Researcher;
Toomas Klementi, Early Stage Researcher;
Olga Vovk, Early Stage Researcher;
Markus Bertl, PhD student;
Riin Ehin, PhD student.
Janek Metsallik, Expert of E-Health, Phd student;
Maarja-Liis Elland, E-Health Analyst
Barbara Haage, Project Manager;
Liis Hamburg, Project Manager;
Maarja Kuslapuu, Project Manager;
Mall Maasik, Project Manager;
Kerli Metsla, Project Manager;
Kadi Lubi, Health Care Specialist;
Kerli Luks, Health Care Specialist;
Tanel Ross, Health Care Specialist;
Helen Staak, Study Programme Communication Officer.

Key words: Digital health, eHealth, change management in health care

Competency

The core competencies of the research group are the development of IT solutions related to digitalization of health care (e-health) and research of the interoperability factors necessary for their implementation. Factors to be studied include strategies, standards, IT architecture, data statuses and databases used for large (national or regional) e-health systems. In 2021, the research team's more specific activities were related to the medical and health care digital data quality, architecture and models, evaluation and use of digital health technologies and digital health education for doctors and nurses. Also, the development and research of IT solutions related to personal medicine.

Main Activities of the eMed Lab in 2021

Conducting research in areas of digital health data models, clinical decision support systems, evaluation of digital health technologies, user behavior concerning web-based health and medical data access, and components and factors for digitizing healthcare. Participation and presentations in various international research and development projects. Conducting a Master's Program in Health Care Technology. Projects´ management and writing new projects applications and tenders proposals. In 2021, the Center carried out research on the following projects and contracts:

- Framework and proposals supporting the reimbursement of digital health solutions (Estonian Health Insurance Fund);
- Creating a seamless care pathway for people with a stroke (Estonian Health Insurance Fund);
- Digital literacy training for GPs (Ministry of Economic Affairs and Communications);
- Research topics of 7 doctoral students in the field of digital health.

Participation in the following significant projects

- In-service training in digital literacy for family doctors and nurses;
- Development of universal data model and continuity of care processes based on international standards for new generation health information systems;
- Process analysis of innovation competition of remote services to Estonian Health Insurance Fund Nordic eHealth for Patients: Benchmarking and Developing for the Future;
- Opening of research topic of doctoral student Priit Kruus about teledermoscopy;
- Process analysis of innovation competition of remote services to Estonian Health Insurance Fund.

Planning and coordinating the Master's program and supervising Master's theses were satisfactory. The team leader of the program is Priit Kruus. The number of people wishing to study is still higher than planned 25 students, which means that young people have an interest in learning about health care technology. In 2020, PhD students Janek Metsallik and Markus Bertl worked in the eMedLab.

Selected publications

- Laissaar, M.; Hallik, R.; Sillaste, P.; Ragun, U.; Pärn, M.-L.; Suija, K. (2021). Translation and cultural adaptation of IPOS (integrated palliative care outcome scale) in Estonia. Journal of Patient-reported Outcomes, 5 (1), #15. DOI: 10.1186/s41687-021-00288-z.
- *Laissaar, M.; Hallik, R.; Sillaste, P.; Ragun, U.; Pärn, M.-L.; Suija, K. (2021). Translation and cultural adaptation of IPOS (integrated palliative care outcome scale) in Estonia. Journal of Patient-reported Outcomes, 5 (1), #15. DOI: 10.1186/s41687-021-00288-z.*

Planning and coordinating the Master's program and supervising Master's theses were on good level. The team leader of the program is Kadi Lubi who replaced Priit Kruus last year. The number of people wishing to study is still higher than planned 25 students, which means that young people have an interest in learning about health care technology.
In 2021, 8 PhD students worked in the eMedLab. One new doctoral student, Priit Kruus, was admitted.
The staff of our center was active internationally: in several web based events, several presentations were made. We have cooperation with universities of Nordic countries, Kyoto University from Japan, with several Finnish research and development institutions, with the University of Applied Sciences in Flensburg and in Regensburg and many others. We also have close co-operation with Estonian start-ups in the field of digital health, as well as with leading hospitals – East and West Tallinn Central Hospitals, North Estonia Medical Center, and Health Insurance Fund, TEHIK, Genome Center and several IT companies.
In 2021, 1 doctoral student and some academic staff started working at the eMedLab, and in essence there are 20 people in academic work. In addition, eMedLab had contracts with several specialists (nearly 20) to carry out our master´s program 12 subjects.
The eMedLab teaching, development and research work is in a very interesting area – digital health/e-Health – which is a hot topic worldwide. This gives a positive background to our center staff.
The budget of the eMedLab was doubled in 2021 over to 500 thousand euros, of which about one third is earmarked for teaching. Only the teaching staff costs are about 150 thousand euros a year. Working in the field of e-health in parallel with the teaching work gives a lot to the content of teaching and allows to teach the skills needed in real life.

Outstanding research results

The staff of our center were very active internationally: in several countries and events, a couple of hundred presentations were made. We have cooperation with Kyoto University and Keio University from Japan, with several Finnish research and development institutions, with the University of Applied Sciences in Flensburg and in Regensburg and many others. We also have close co-operation with Estonian start-ups in the field of e-health, as well as with leading hospitals – East Tallinn Central Hospital, North Estonia Medical Center, and Health Insurance Fund, TEHIK, Genome Center and several IT companies.
In 2020, 4 doctoral students and some academic staff started working at the eMedLab, and in essence there are 20 people in academic work. In addition, eMedLab had contracts with several specialists (nearly 20) to carry out our master´s program 12 subjects.
The eMedLab teaching, development and research work is in a very interesting area – digital health/e-Health – which is currently a hot topic worldwide. This gives a positive background to our center staff.

The budget of the eMedLab is between EUR 200-250 thousand, of which about half is earmarked for training and the other half for different projects. Only the teaching staff costs are about 150 thousand euros a year. Working in the field of e-health in parallel with the teaching work gives a lot to the content of teaching and allows to teach the skills needed in real life. To ensure the eMedLab's sustainability, we need to think about the following:

- Optimizing teaching (less of own subjects, more collaboration with other curricula, fewer students in our subject area, more focused topics with master's theses to ensure the best involvement of the eMedLab's staff;
- Closer co-operation with organizations working in the field of e-health in Estonia to find funding specifically for development and research in their field (Ministry of Social Affairs, TEHIK, Health Insurance Fund, UT Estonian Genome Bank, maybe also some e-health companies);
- More precise selection of international project applications in order to avoid wasting time for the eMedLab's staff to write applications with a low probability of funding.

ASP priority areas:

- Dependable IT solutions;
- Future governance.

Field of research

3. Medical and health sciences - 3.3 Health sciences
3. Medical and health sciences - 3.4 Medical biotechnology

T115 Medical technology

Participation of the research group members in the activities of international R&D organizations, membership of foreign academies

Two of the Labs employees are World Bank and one Asian Development Bank and German Development Bank KfW consultants in the field of eHealth.

Information on applied research and development activities of the research group

eMedLab has got funding of the following international projects for the next two years:

- HealthSense. In cooperation with Health and Welfare Information System Center and Software Technology and Applications Competence Centre (STACC).
- Nordic eHealth for Patients: Benchmarking and Developing for the Future (NordForsk). The consortium includes 4 universities from Sweden and 1 university from Finland, Norway and USA.