

TTÜ TEHNOMEEDIKUM
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2012

1. Struktuur

TTÜ Tehnomeedikum, TTU Technomedicum
Direktor Kalju Meigas

- **Biomeditsiinitehnika instituut, Department of Biomedical Engineering, Ivo Fridolin**
Biomeditsiinitehnika õppetool, Chair of Biomedical Engineering, Kalju Meigas
Meditsiinifüüsika õppetool, Chair of Medical Physics, Ivo Fridolin
- **Kardioloogiakeskus, Centre of Cardiology, Jüri Kaik**
Elektrofüsioloogia õppetool, Chair of Electrophysiology, Jüri Kaik
- **Kliinilise meditsiini instituut, Department of Clinical Medicine, Ruth Sepper**
Kliinilise meditsiini õppetool, Chair of Clinical Medicine, Ruth Sepper
Tervishoiutehnoloogia õppetool, Chair of Health Care Technology, Peeter Ross

NMR grupp, NMR group, Ago Samoson

2. Teadus- ja arendustegevuse (edaspidi T&A) iseloomustus

Research and development activities of Technomedicum (TM) cover medicine, technology and biomedicine, degree studies related to medicine, biomedicine and technology, relevant continuing education courses as well as teaching of medical disciplines organized by other TUT academic units on the master and doctoral level. In addition to TUT academic and research staff, doctor-teachers and doctor-researchers from several hospitals participate in TM academic and research activities.

The structure of TM includes Department of Biomedical Engineering, Department of Clinical Medicine and Centre of Cardiology and NMR group.

BIOMEDITSIINITEHNIKA INSTITUUDI (*Department of Biomedical Engineering*) T&A iseloomustus

2.1.1. teadustöö kirjeldus (*inglise keeles*);

- **Biofluid optics (BFO) team**: The aim of the BFO team was to develop an optical technology for monitoring of uremic toxins related to malnutrition-inflammation complex syndrome (MIA) on the ESRD patients and to CVD risk in general. The project aims to develop a novel optical technology for monitoring of uremic toxins (UTox) related to malnutrition-inflammation syndrome on the end stage renal disease patients and to cardiovascular disease (CVD), helping doctors to improve the life quality of the patients, and decrease hospitalisations and interventions.

- Optical monitoring possibilities of Utox in dialysate were studied as:
- algorithms for small Utox (uric acid (UA), creatinine, phosphate) concentration measurements were worked out;
- new method is under development for middle (beta2-microgl.) and protein bound (indoxyl sulfate) Utox determination.
- HPLC ja LC-MS methods enabled to:
- show, that the medicine Paracetamol+metabolites influence optical dialysis monitoring, UA levels in the blood and elimination profile in dialysis;
- detect 30 HPLC peaks in the blood and dialysate, among them were identified and quantified 10 solutes;
- confirm the hypothesis, that UV absorbance does not enable estimation of protein bound Utox in dialysate
- **Diagnostics of cardiovascular diseases:** Atherosclerosis is the main cause for deaths in Europe. Early preventive actions are essentially important as Estonia have the highest mortality level for heart-vascular diseases in Europe. Improvement of non-invasive methods for diagnostics of atherosclerosis in very early stage is extremely important. The aim of our research is to develop a new methodology to determine dynamic compliance of arteries and consider usefulness in early diagnostics of atherosclerosis on the basis of optical methods worked out by our group for arterial blood pressure monitoring. The hypothesis is that simultaneous and quick registration of mechanical movements of arteries walls, pulse wave velocity and shape, and dynamics of blood pressure creates a system of parameters for estimation of dynamic compliance of arteries and to get early diagnoses of atherosclerosis. Expected results: Complex optical method for early diagnose of atherosclerosis will be developed. Different physiological parameters and technical solutions (e.g. mechanical movements of arteries, pulse wave shape, pulse wave velocity and local blood pressure) will be investigated.
- **Brain research:** The research activity was aimed to development of quantitative measures and algorithms for early detection of characteristic changes in the EEG related to the mental disorders and the effect of external physical stressor on the brain. For this purpose, the linear and nonlinear methods for interpretation of the EEG signal and explanation of the processes in the brain were applied.
A method and algorithm to determine depressive disorders or other mental disorders based on imbalances of the combination of the powers of specific EEG frequency bands selected higher and lower of the spectrum maximum has been developed and granted as US patent. The method can be used as quick and easy noninvasive tool for diagnosing brain disorders as separate algorithm, as a part of an EEG recording and analysis device and as a separate device.
The mechanism of diffusion as possible bases for alterations in the brain bioelectrical activity was proposed and experimental investigation of the model performed. Results of the experimental study demonstrate that external electromagnetic field affects diffusion and, consequently, causes excitation of the brain. The disturbance of the EEG was detected at the field strengths 20 dB lower than the limits recommended by health protection authorities.

2.1.2. Aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*).

- **Biofluid optics:** 5 PhD students are involved and 2 MSc works were defended with the project related topics. Papers: 5 pcs. 1.1; 1 pcs. 1.2; 5 pcs. 3.1; 1 pcs. 5.1, 4 pcs. 5.2, and 2 patent appl.
- **Diagnostics of cardiovascular diseases:** The second derivative method for analysis of optically registered pulse waveform was developed. The bandwidth of the each pulse wave signal period is limited by using novel developed signal processing algorithm. Furthermore, the optimal pulse wave bandwidth was found. In addition, the amplitude and length of each pulse wave signal period is normalized. The parameters from pulse waveform and from second derivative waveform was extracted and compared between healthy and diabetes group. Most of the

parameters had remarkable correlation with subject's age. Some of the parameters showed noticeable differences between healthy and diabetes groups.

- **Brain research:**

- US patent US8244341B1 Method and device for diagnosing a mental disorder by measuring bioelectromagnetic signals of the brain;
- Detection of the effect of microwave radiation on the EEG at the field power strengths much lower than recommended health protection limits.

2.2. Uurimisgrupi kuni 5 olulisemat publikatsiooni läinud aastal.

Biofluid optics:

- Arund J., Tanner R., Uhlin F., Fridolin I. Do Only Small Uremic Toxins, Chromophores, Contribute to the Online Dialysis Dose Monitoring by UV Absorbance? *Toxins*. 2012; 4(10):849-861. doi:10.3390/toxins4100849
- Holmar, Jana; Fridolin, Ivo; Uhlin, Fredrik; Lauri, Kai; Luman, Merike (2012). Optical Method for Cardiovascular Risk Marker Uric Acid Removal Assessment During Dialysis . *The Scientific World Journal*, Vol 2012 <http://dx.doi.org/10.1100/2012/506486>]
- Enberg P, Uhlin, F., Fridolin I, Holmar J, Fernström (2012). „Phosphate Removal During Haemodialysis Estimated by UV absorbance“ , *Nephron Clin Pract* 2012;121:c1-c9 (DOI: 10.1159/000341598) <http://content.karger.com/ProdukteDB/produkte.aspDOI=10.1159/000341598>
- F. Uhlin and I. Fridolin, “Optical Monitoring of Dialysis Dose”, A.T. Azar (Ed.): *Modeling and Control of Dialysis Systems*, SCI 405, pp. 867–928, Springer, 2012

Diagnostics of cardiovascular diseases:

- Okada Y, Sim X, Go MJ, Wu JY, Gu D, Viigimaa M et al. Meta-analysis identifies multiple loci associated with kidney function-related traits in east Asian populations. *Nat Genet*. 2012 Jul 15;44(8):904-9.
- H. Vaverkova, M. Farnier, M. Averna, L. Missault, M. Viigimaa, Q. Dong, A. Shah, A. Johnson-Levonas, P. Brudi "Lipid-Altering Efficacy of Ezetimibe/Simvastatin 10/20 mg Compared to Rosuvastatin 10 mg in High-Risk Patients with and without Type 2 Diabetes Mellitus Inadequately Controlled Despite Prior Statin Monotherapy", *Cardiovascular Therapeutics* 30 (2012) 61-74;
- Pilt, Kristjan; Meigas, Kalju; Temitski, Kristina; Viigimaa, Margus (2012). Second derivative analysis of forehead photoplethysmographic signal in healthy volunteers and diabetes patients. In: *IFMBE Proceedings: World Congress on Medical Physics and Biomedical Engineering*, Peking, 26-31 Mai 2012. IFMBE, 2012, 410 - 413.
- K. Pilt, K. Meigas, K. Temitski and M. Viigimaa, "The analysis of finger photoplethysmographic waveform in healthy volunteers and diabetes patients", *ISBEMP-12, IFMBE Proceedings*, 2012, Volume 38, 2013, pp 55-58
- K. Temitski, J. Lauri, K. Pilt, K. Meigas, M. Viigimaa, "Assessment of algorithms for detecting an arterial pulse pressure wave equiphase point", *Electronics Conference (BEC)*, 2012 13th Biennial Baltic, 2012, pp. 191-194

Brain research:

- Suhhova, A., Bachmann, M., Karai, D., Lass, J., Hinrikus, H. (2012) Effect of microwave radiation on human EEG at two different levels of exposure. *Bioelectromagnetics*, vol.34, Article first published online : 31 DEC 2012, DOI: 10.1002/bem.21772
- Suhhova, Anna; Bachmann, Maie; Lass, Jaanus; Aadamsoo, Kaire; Võhma, Ülle; Hinrikus, Hiie. (2012). EEG Spectral Asymmetry Index for Detection of Depression at Individual and Fixed Frequency Bands. *World Congress on Medical Physics and Biomedical Engineering* May 26-31, 2012 Beijing, China (589 - 592). Springer

2.3 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

Margus Viigimaa was awarded as a honorary member of the Hungarian Society of Hypertension.

2.4 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Hiie Hinrikus - International Academy for Medical and Biological Engineering (IAMBE), Fellow
Hiie Hinrikus – European Alliance for Medical and Biological Engineering and Science – Founding Fellow (2012)

Margus Viigimaa - Euroopa Hüpertensiooni Ühingu juhatus liige ja töögrupi „Hüpertensioon ja seksuaalne düsfunktsioon“ juhataja ning rahvusvaheliste teadusajakirjade "Blood pressure", "Journal of Hypertension" ja "Seminars in Cardiology" toimetuste liige;

Kalju Meigas - rahvusvahelise ühingu IFMBE meditsiinitehnoloogia divisjoni juhatus liige ja rahvusvaheliste teadusajakirjade "Measurement Science Review" ja "Bioelectromagnetism" toimetuste liige, samuti rahvusvahelise doktorikooli "International Graduate School in Biomedical Engineering and Medical Physics" juhatus (management board) liige.

2.5 Aruandeaasta tähtsamad T&A finantseerimise allikad.

- SF0140027s07, Biosignaalide interpreteerimine meditsiinitehnikas, sihtfinantseeritav teema
- Integreeritud elektroonikasüsteemide ja biomeditsiinitehnika tippkeskus CEBE – Eesti tippkeskus
- Uudne optiline meetod ureemiliste toksiinide - alatoitumuse ja kroonilise põletiku ning SVH riski potentsiaalsete markerite, monitooringuks – ETF grant
- TTÜ baasfinantseerimine

2.6 Soovi korral lisada aruandeaastal saadud T&A-ga seotud tunnustusi (va punktis 2.3 toodud tunnustused), ülevaate teaduskorralduslikust tegevusest, teadlasmobiilsusest ning anda hinnang oma teadustulemustele.

KARDIOLOOGIAKESKUSE (Centre of Cardiology) T&A iseloomustus

2.1 teadustöö kirjeldus (*inglise keeles*);

The aim of our team's study was to investigate the correlation between non-invasive markers of prolonged and inhomogeneous ventricular repolarization (VR), which can be used for improvement of sudden cardiac death (SD) risk stratification and prediction of antiarrhythmic drug treatment efficacy/arrhythmogenic effect in patients with various heart diseases. The hypothesis presumes, that a combination of different indicators will improve SD risk stratification and prediction of antiarrhythmic drug treatment efficacy/arrhythmogenic effect.

2.1.1. Aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*).

New algorithms for ECG QT interval variability and QT interval rate-adaptation evaluation were developed, which (1) essentially correlate with generally recognized markers of elevated myocardial electrical instability, such as high-grade ventricular ectopy, low ejection fraction, decreased heart rate variability, etc, (2) do not depend on (or do so to a very limited extent) changes of structure of left ventricle (myocardial infarction, heart failure, left ventricular hypertrophy), and (3) can be easily adapted for Holter monitor or ECG device are used in sleep research in Estonian sleep medicine centres.

Application of different novel QT/RR regression models and heart rate correction formulas to clinical 24-hour ECG recordings, mainly linear and parabolic correction models, turned out to discriminate the different myocardial electrical instability (MEI) patient groups. A novel parameter-difference in standard deviations of recorded QTc interval values during Holter monitoring proved to be informative MEI marker.

Estonian patent application P 201100016 approved.

2.2. Uurimisgrupi kuni 5 olulisemat publikatsiooni läinud aastal.

- Pshenichnikov, I.; Shipilova, T.; Kaik, J. (2012). Impact of myocardial electrical instability parameters, arterial hypertension, and main cardiovascular risk factors on cardiovascular mortality and morbidity of Tallinn women. 22nd European Meeting on Hypertension and Cardiovascular Protection. London, April 26 – 29. Journal of Hypertension, Volume 30, e-Supplement A., 2012, e470 – e470.
- Shipilova, Tatjana; Pshenichnikov, Igor; Karai, Dmitri; Kaik, Jüri (2012). Non-dipping Pattern of Heart Rate in Relation to Target Organ Damage in Women with Uncontrolled Essential Hypertension. 22nd European Meeting on Hypertension and Cardiovascular Protection. London, April 26-29. Journal of Hypertension, Volume 30, e-Supplement A., 2012, e222 – e222.
- Shipilova, T.; Pshenichnikov, I.; Karai, D.; Ripulk, J.; Meigas, K.; Kaik, J. (2012). 24-Hour Pattern of Heart Rate and Left Ventricular Hypertrophy in Women with Arterial Hypertension. In: *Venemaa foorumi "Kardioloogia 2010" 28.02.-1.03.2012 materjalid*: Moskva., 2012, 166.

2.3 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

2012. aastal struktuuriüksuse töötajaid rahvusvaheliselt ei tunnustatud.

2.4 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste TjA-ga seotud välisorganisatsioonide liikmed.

Jüri Kaik – European Society of Cardiology (ESC), Fellow,

Jüri Kaik – rahvusvahelise teadusajakirja "Seminars in Cardiology" toimetuste liige;

KLIIINILISE MEDITSII NIISTITUUDI (Department of Clinical Medicine) T&A iseloomustus

2.1 KMI koosseisu kuuluvate uurimisgruppide

2.1.1. Teadustöö kirjeldus (*inglise keeles*);

- Investigations on causes and development and early diagnostics of asthma and chronic obstructive lung disease – Prof. Ruth Sepper (leader of research group), senior researcher Kaiu Prikk, post-graduates Sirje Marran, Berit Pilden and Ave Nagelmann;
- Project „CHROMED“ – Clinical Trials for Elderly patients with Multiple Disease – Ruth Sepper, Kaiu Prikk;
- E-health RjaD projects: eMedic – Developing New Practices for Teleconsultation and Diabetes – project manager Madis Tiik, senior researcher Peeter Ross, project coordinators Veronika-Palmiste-Kallion, Mall Maasik;
- PrimCare IT – Counteracting brain drain and professional isolation of health professionals in remote primary health care through tele-consultation and tele-mentoring to strengthen social conditions in remote BSR – project manager Madis Tiik, senior researcher Peeter Ross.

2.1.2. Aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*).

- We demonstrated that lung function deviation and lung structural changes are present in chronic smokers before the clinical signs of airway obstruction reveal and these changes are associated with early onset of chronic obstructive pulmonary disease (COPD).
- We demonstrated as a proof-of-principle the tissue uptake of an inhaled drug in the *in vivo* lung by use of matrix-assisted laser desorption ionization mass spectrometry imaging analysis.

2.2 Uurimisgrupi kuni 5 olulisemat publikatsiooni läinud aastal.

- Sepper R, Prikk K, Metsis M, Sergejeva S, Pugatsjova N, Bragina O, Marran S, Fehniger TE. *Mucin5B expression by lung alveolar macrophages is increased in long-term smokers*. J Leukoc Biol. 2012;92:319-324.
- Marko-Varga G, Végvári A, Rezeli M, Prikk K, Ross P, Dahlbäck M, Edula G, Sepper R, Fehniger TE. *Understanding drug uptake and binding within targeted disease micro-environments in patients: a new tool for translational medicine*. Clin Transl Med. 2012,1(1):8.
- Marko-Varga G, Végvári Á, Welinder C, Lindberg H, Rezeli M, Edula G, Svensson KJ, Belting M, Laurell T, Fehniger TE. *Standardization and utilization of biobank resources in clinical protein science with examples of emerging applications*. J Proteome Res. 2012;11:5124-34
- Parv L, Saluse J, Aaviksoo A, Tiik M, Sepper R, Ross P. *Economic impact of a nationwide interoperable e-Health system using the PENG evaluation tool*. Stud Health Technol Inform. 2012;180:876-80.
- Brjalín V, Salupere R, Tefanova V, Prikk K, Lapidus N, Jõeste E. *Sarcoidosis and chronic hepatitis C: a case report*. World J Gastroenterol. 2012;18:5816-20

2.3 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

2012. aastal struktuuriüksuse töötajaid rahvusvaheliselt ei tunnustatud.

2.4 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Ruth Sepper - FP7 Programm Tervis programmikomitee, ekspert
Ruth Sepper - Marie Curie Individual fellowships, Panel Life, FP7, ekspert
Ruth Sepper - American Thoracic Society, liige
Ruth Sepper - Gruusia Teadusfond, ekspert
Ruth Sepper - Eur. Respir. J, Clinical Chem. Acta, retsensent
Ruth Sepper - J Proteomics, retsensent
Kaiu Prikk - European Respiratory Society, liige
Peeter Ross - European Society of Radiology, liige
Peeter Ross - Finnish Society of Telemedicine and eHealth, liige
Madis Tiik - Finnish Society of Telemedicine and eHealth, liige
Kalev Karu - International Society of Quality in Health Care, liige
Vahur Valvere - Euroopa Meditsiinilise Onkoloogia Ühing (ESMO), liige
Vahur Valvere - Breast Cancer International Research Group, liige
Vahur Valvere - American Society of Clinical Oncology, liige
Hanna-Kaarina Pohjonen - UEMS eHealth Working Group, liige
Thomas Fehniger - European Proteomics Association, special editions editor on Clinical Proteomics
Thomas Fehniger - The American Chemical Society, special editor
Thomas Fehniger - J Proteome Research, editor
György Marko-Varga - Board member of the Swedish Academy of Pharmaceutical Society, Drug Analysis Section

György Marko-Varga - Initiated the Swedish Proteomic Society (SPS) and currently the President

György Marko-Varga - President of European Proteomics Association "EuPA"

György Marko-Varga - International Society for Translational Medicine Faculty Member

György Marko-Varga - HUPO HPP Chromosome Initiative Co-Chair

György Marko-Varga - Swedish representative "Imaging Mass Spectrometry –New Tools for Healthcare Research" European Union

György Marko-Varga - Member of the Advisory Board "Comprehensive Analytical Chemistry Book Series, Elsevier"

György Marko-Varga - Member of the Editorial Board, Journal of Pharmaceutical and Biomedical Analysis, Elsevier Science Publisher

György Marko-Varga - Assoc. Editor (Europe) Journal of Proteome Research, American Chemical Society

György Marko-Varga - Member of the Editorial Board, Current Pharmaceutical Analysis, Bentham Science Publishers

György Marko-Varga - Member of the Editorial Board, Journal of Multiple Organ Dysfunction, Bentham Science Publisher;

György Marko-Varga - Invited to the Editorial Board of "Respiratory and Translational Medicine", Springer Int. Science Publisher

Ave Minajeva - Federation of the Societies of Biochemistry and Molecular Biology, liige

Katrin Gross-Paju - Euroopa Neuroloogia Ühingu Föderatsiooni Neurorehabilitatsiooni paneeli liige

Katrin Gross-Paju - Advisory Board – Multiple Sclerosis – Central East Europe, liige

2.5 Aruandeaasta tähtsamad T&A finantseerimise allikad.

MTT12 - Biomarkers Measuring Inflammation, Mobilias Top Researcher Grant

VE430 - Measurement of airway wall thickness in COPD, Välisleping AstraZeneca RD with identification of new biological markers in airway tissue from COPD patients

Lep11009 - A multicenter, open-label, dose ranging study to determine the pharmacokinetics and pharmacodynamics of mepolizumab in moderate to severe asthma subjects, Siseriiklik leping GlaxoSmithKline Eesti OÜ

Lep10121 - A randomised, double-blind, placebo -controlled, parallel-group, multicentre, dose ranging study to evaluate the efficacy and safety of Losmapimod (GW856553) tablets administered twice daily compared with placebo for 25 weeks in adults subjects with chronic obstructive pulmonary disease Siseriiklik leping GlaxoSmithKline Eesti OÜ

VIR547 - Developing New Practices for Teleconsultation and Diabetes Välisleping, ERDF

VIR553 - Counteracting brain drain and professional isolation of health professionals in remote primary health care through tele-consultation and telementoring to strengthen social conditions in remote BSR Välisleping, ERDF

VFP558 - CHROMED - Clinical Trials for Elderly patients with Multiple Disease, Välisleping, EC

2.6 Soovi korral lisada aruandeaastal saadud T&A-ga seotud tunnustusi (va punktis 2.3 toodud tunnustused), ülevaate teaduskorralduslikust tegevusest, teadlasmobiilsusest ning anda hinnang oma teadustulemustele.

Kliinilise meditsiini instituudi teadus- ja arendustegevuse valdkonnad on:

- Astma ja kroonilise obstruktiivse kopsuhaiguse tekke, arengu ja varase diagnostika uurimise põhjused (*Investigations on causes and development and early diagnostics of asthma and chronic obstructive lung disease*). Teadussuuna juht prof. Ruth Sepper, kaastöötajad van. teadur Kaiu Prikk, prof. Thomas Fehniger, doktorandid Berit Pilden, Sirje Marran ja Ave Nagelmann.

- E-tervise teadussuund (*E-health*), mida juhib rahvusvaheline teadlaskond, kuhu kuuluvad Tallinna ja Helsingi Tehnikaülikooli dotsent Hanna Pohjonen, projektijuht Madis Tiik, PhD, dotsent ja vanemteadur Peeter Ross, PhD.

NMR GRUPP

Teadustöö kirjeldus (*inglise keeles*)

2.1.1. Research concentrated on NMR engineering, as a basis on novel experiments and increased analytical capacity. Simultaneously, associated methods were numerically analyzed and optimized.

2.1.2. aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*)

Establishment of a new laboratory:

- assembly and installation of 60MHz permanent magnet NMR;
- design and construction of 70 kHz MAS probe, compatible with permanent magnet bore size of 18mm;
- Series on Li NMR measurements in batteries;
- breaking 100 kHz barrier in MAS;
- development measurements of protein dynamics in ms range;
- installation of universal micro-precision machining centre;
- design, construction and test of universal 300C flow MAS probe for in-situ catalyses studies;
- manuscript on metabolite NMR analyses of blood serum.

2.2. Kuni 5 olulisemat publikatsiooni läinud aastal.

- Zhao-Karger, Zhirong; Witter, Raiker; Gil Bardaj, Elisa; Wang, Di; Cossement, Daniel; Fichtner, Maximilian (2013). Altered reaction pathways of eutectic LiBH₄-Mg(BH₄)₂ by nanoconfinement. *Journal of Materials Chemistry A*, 1 - 8.
- Zhao-Kargera, Zhirong; Witter, Raiker; Gil Bardaj, Elisa; Wang, Di; Cossement, Daniel; Fichtner, Maximilian (2012). Influence of Nanoconfinement on Reaction Pathways of Complex Metal Hydrides. *Energy Procedia*, 29, 731 - 737.
- Witter, Raiker; Roming, Marcus; Feldmann, Claus; Ulrich, Anne S. (2012). Multilayered core-shell structure of polyol-stabilized CaF₂ nanoparticles characterized by NMR. *Journal of Colloid and Interface Science*, 1 - 28. [ilmumas]
- Hu, J.; Ren, S.; Witte, R.; Fichtner, M. (2012). Solar Cells: Catalytic Influence of Various Cerium Precursors on the Hydrogen Sorption Properties of NaAlH₄. *Advanced Energy Materials*, 2(5), 606 (Back Cover)
- Brendler, Erica; Heine, Thomas; Seichter, Wilhelm; Wagler, Jörg; Witter, Raiker (2012). ²⁹Si NMR Shielding Tensors in Triphenylsilanes – ²⁹Si Solid State NMR Experiments and DFT-IGLO Calculations. *Zeitschrift für Anorganische und Allgemeine Chemie*, 1
- Hu, Jianjiang; Ren, Shuhua; Witter, Raiker; Fichtner, Maximilian (2012). Catalytic Influence of Various Cerium Precursors on the Hydrogen Sorption Properties of NaAlH₄. *Advanced Energy Materials*, 2(5), 560 - 568.

2.3. Loetelu töötajate rahvusvahelistest tunnustustest.

Ago Samoson oli kutsutud esineja 2 rahvusvahelisel konverentsil (EU ja planetaarne).

2.4. Loetelu töötajatest, kes on välisakadeemiade või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Ago Samoson on valitud ISMAR Fellow ja AMPERE komitee rahvuslik esindaja

2.5. Aruandeaasta tähtsamad T&A finantseerimise allikad.

TTÜ baasfinantseering, sponsorite toetus

2.6. Aruandeaastal saadud T&A-ga seotud tunnustused, ülevaate teaduskorralduslikust tegevusest, teadlasmobiilsusest ning anda hinnang oma teadustulemustele.

Estonian Magnet Week workshop organiseerimine 29.09-05.10.2013.

Teadustulemused olid NMR grupil normaalsed.

2.7 Teadus- ja arendustegevuse teemade ja projektide nimetused (*Eesti Teadusinfosüsteemi, edaspidi ETIS, andmetel*)

- Haridus- ja Teadusministeerium

– sihtfinantseeritavad teemad:

T027, Biosignaalide interpreteerimine meditsiinitehnikas, Fridolin Ivo (2007 – 2012)

T127, Biosignaalide interpreteerimine meditsiinitehnikas, Kaik Jüri (2007 – 2012)

– baasfinantseerimise toetusfondist rahastatud projektid (sh TTÜ tippkeskused):

B618, Elektroni-Tuuma magnetresonants (ENMR), Ago Samoson (2010 – 2013)

B13, Professor Margus Viigimaa uurimisgrupi toetamine (2012 – 2012)

– riiklikud programmid:

- Teiste ministeeriumide poolt rahastatavad riiklikud programmid:

- Uuriija-professori rahastamine:

- SA Eesti Teadusfond/Eesti Teadusagentuur

– grandid:

ETF9229, EM modelleerimise rakendamine TMR-is, Samoson Ago (2012 – 2015)

ETF862, Uudne optiline meetod ureemiliste toksiinide - alatoitumuse ja kroonilise põletiku ning SVH riski potentsiaalsete markerite, monitooringuks, Fridolin Ivo (2011 – 2014)

– ühisgrandid välisriigiga:

– järel doktorite grandid (SA ETF ja Mobilitas):

ERMOS109, Ilumets Helen, Biomarkers for smoking related early airway inflammation with special focus on protease-antiprotease imbalance (1.01.2013 - 31.12.2015)

– tippteadlase grandid (Mobilitas):

MTT68, Witter Raiker, Microwave and Scale enhanced NMR of Micro-Drops, -Leaflets, Cells and Nanoparticles (1.07.2011 - 31.07.2015)

MTT12, Fehniger Thomas, Põletiku biomõõdikud (1.01.2010 - 31.12.2012)

- Ettevõtluse Arendamise SA

– eeluuringud:

– arendustoetused:

- SA Archimedesega sõlmitud lepingud

– infrastruktuur (nn „mini-infra“, „asutuse infra“):

– Eesti tippkeskused:

TAR8077DB, Integreeritud elektroonikasüsteemide ja biomeditsiinitehnika tippkeskus, Ivo Fridolin (7.07.2008 - 31.08.2015)

– riiklikud programmid:

– muud T&A lepingud:

- SA Keskkonnainvesteeringute Keskusega sõlmitud lepingud:

- Siseriiklikud lepingud:

- EL Raamprogrammi projektid:

VFP412, Euromagnet, Samoson Ago (1.01.2009 - 31.12.2012)

VFP413, Ida-Euroopa TMR kasutajate juurdepääsu ja teenuste parandamine üle-euroopalise efektiivse ja koordineeritud TMR võimekuse suunas globaalse teaduskoostöö ja tehnoloogilise progressi nimel, Samoson Ago (1.01.2009 - 31.01.2013)

- Välisriiklikud lepingud:

VIR523, Töövõime ja sotsiaalne kaasatus, Meigas Kalju (1.05.2011 - 31.12.2013)

VIR547, e-Medic - Diabeedi kaugjälgimise uute lahenduste väljatöötamine, Sepper Ruth (1.05.2011 - 31.12.2013)

V511, Sclerosis multiplex'i haigete iseseisev osalus, riskiteadlikkus ja otsustusvõimekus raviotsustuse protsessis, Gross-Paju Katrin (1.03.2010 - 31.03.2012)

EL õppe-arendusprojektid

VY416, Biomeditsiinitehnoloogia õppekava arendamine ja harmoniseerimine Euroopas, Meigas Kalju (15.01.2009 - 14.01.2012)

2.8 Struktuuriüksuse töötajate poolt avaldatud eelretsenseeritavad teaduspublikatsioonid (*ETIS klassifikaatori alusel 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1 ja 5.1*).

1.1

Shipilova, T.; Pshenichnikov, I.; Karai, D.; Ripulk, J.; Kaik, J. (2012). 24-hour Pattern of Heart Rate in Relation to Organ Damage in Women with Arterial Hypertension. *Kardiologiya*, 8, xx - xx. [ilmumas]

Brendler, Erica; Heine, Thomas; Seichter, Wilhelm; Wagler, Jörg; Witter, Raiker (2012). 29Si NMR Shielding Tensors in Triphenylsilanes – 29Si Solid State NMR Experiments and DFT-IGLO Calculations. *Zeitschrift für Anorganische und Allgemeine Chemie*, 1

Hu, Jianjiang; Ren, Shuhua; Witter, Raiker Witter; Fichtner, Maximilian (2012). Catalytic Influence of Various Cerium Precursors on the Hydrogen Sorption Properties of NaAlH₄. *Advanced Energy Materials*, 2(5), 560 - 568.

Arund, J; Tanner, R; Uhlin, F; Fridolin, I. (2012). Do Only Small Uremic Toxins, Chromophores, Contribute to the Online Dialysis Dose Monitoring by UV Absorbance? *Toxins*, 4(10), 849 - 861.

Zhao-Kargera, Zhirong; Witter, Raiker; Gil Bardaj?a, Elisa; Wang, Di; Cossement, Daniel; Fichtner, Maximilian (2012). Influence of Nanoconfinement on Reaction Pathways of Complex Metal Hydrides. *Energy Procedia*, 29, 731 - 737.

Sepper, R.; Prikk, K.; Metsis, M.; Sergejeva, S.; Pugatsjova, N.; Bragina, O.; Marran, S.; Fehniger, T. (2012). Mucin5B expression by lung alveolar macrophages is increased in long-term smokers. *Journal of Leukocyte Biology*, 92(2), 319 - 324.

Witter, Raiker; Roming, Marcus; Feldmann, Claus; Ulrich, Anne S. (2012). Multilayered core-shell structure of polyol-stabilized CaF₂ nanoparticles characterized by NMR. *Journal of Colloid and Interface Science*, 1 - 28. [ilmumas]

Tomson, R.; Fridolin, I.; Uhlin, F.; Holmar, J.; Lauri, K.; Luman, M. (2012). Optical Measurement of Creatinine in Spent Dialysate. *Clinical Nephrology*, xx [ilmumas]

Holmar, J.; Fridolin, I.; Uhlin, F.; Lauri, K.; Luman, M. (2012). Optical Method for Cardiovascular Risk Marker Uric Acid Removal Assessment During Dialysis . *The Scientific World Journal*, 2012, 8 pp.

Tanner, R.; Arund, J.; Fridolin, I.; Luman, M. (2012). Paracetamol interferes uric acid levels in uraemic patients revealed by monitoring spent dialysate. *Clinical Nephrology*, xx(xx), xx - xx. [ilmumas]

Enberg, P.; Uhlin, F.; Fridolin, I.; Holmar, J; Fernström, A. (2012). Phosphate Removal During Haemodialysis Estimated by UV absorbance“. *Nephron Clinical Practice* , 121(1), 1 - 9.

Anier, A.; Lipping, T.; Ferenets, R.; Puumala, P.; Sonkajärvi, E.; Rätsep, I.; Jäntti, V. (2012). Relationship between approximate entropy and visual inspection of irregularity in the EEG signal, a comparison with spectral entropy. *British Journal of Anaesthesia*, 106(6), 928 - 934.

Brjalín, V.; Salupere, R.; Tefanova, V.; Prikk, K.; Lapidus, N.; Jõeste, E. (2012). Sarcoidosis and chronic hepatitis C: A case report. *World Journal of Gastroenterology*, 18(40), 5816 - 5820.

1.2

Tamme, Kadri; Minajeva, Ave.; Adamson, Vivika; Ristmägi, Kaarina; Põder, Jaak; Lutsar, Irja (2012). Clinical Findings and Pathologic Changes Associated with Fatal Cases of 2009/2010 Pandemic Influenza A/H1N1 Viral Infection in Estonia. A Retrospective Study. *Medicina (Kaunas)*, 48(1), 48 - 56.

Lönn, Johanna; Shahzad, Faisal; Uhlin, Fredrik; Bengtsson, Torbjörn; Almroth, Gabriel; Nayeri, Fariba (2012). High concentration but low biological activity of hepatocyte growth factor in patients with chronic renal failure . *Advances in Bioscience and Biotechnology*, 3(4), 516 - 523.

Marko-Varga, G.; Végv?ri, ?.; Rezeli, M.; Prikk, K.; Ross, P.; Dahlbäck, M.; Edula, G.; Sepper, R.; Fehniger, T. (2012). Understanding Drug Uptake and Binding within Targeted Disease Micro-Environments in Patients: A New Tool for Translational Medicine . *Clinical and Translational Medicine*, 1(May), 9 pp.

Enberg, Per; Fridolin, Ivo; Holmar, Jana; Fernström, Anders; Uhlin, Fredrik (2012). Utilization of UV Absorbance for Estimation of Phosphate Elimination during Hemodiafiltration. *Nephron Clinical Practice* , c1 - c9.

Hu, J.; Ren, S.; Witter, R.; Fichtner, M. (2012). Solar Cells: Catalytic Influence of Various Cerium Precursors on the Hydrogen Sorption Properties of NaAlH₄. *Advanced Energy Materials*, 2(5), 606 (Back Cover)

1.3

Melnikova, Renata; Pille, Andres; Bogovskaja, Jelena; Pille, Viive; Sergejeva, Svetlana (2012). Caplani sündroom. Haigusjuhu kirjeldus. *Eesti Arst*, 91(7), 361 - 367.

2.1

2.2

3.1

Suhhova, Anna; Bachmann, Maie; Lass, Jaanus; Aadamsoo, Kaire; Võhma, Ülle; Hinrikus, Hiie. (2012). EEG Spectral Asymmetry Index for Detection of Depression at Individual and Fixed Frequency Bands. Long, M. (Toim.). *World Congress on Medical Physics and Biomedical Engineering May 26-31, 2012 Beijing, China* (589 - 592).Springer

Kepler, K.; Meigas, K.; Holmar, J. (2012). Joint biomedical engineering and medical physics master's curriculum project in Estonia. Long, M. (Toim.). *World Congress on Medical Physics and Biomedical Engineering May 26-31, 2012 Beijing, China* (1691 - 1693).Springer

Holmar, J.; Arund, J.; Uhlin, F.; Tanner, R.; Fridolin, I. (2012). New Optical Method for Estimation of Protein Bound Uremic Toxins Elimination. Long, M. (Toim.). *World Congress on Medical Physics and Biomedical Engineering May 26-31, 2012 Beijing, China* (71 - 74).Springer

Uhlin, F.; Fridolin, I. (2012). Optical Monitoring of Dialysis Dose. A.T. Azar (Toim.). *Modeling and Control of Dialysis Systems* (867 - 928).Springer

Kruus, H.; Ubar, R.; Ellervee, P.; Gorev, M.; Pesonen, V.; Devadze, S.; Orasson, E.; Brik, M.; Min, M.; Annus, P.; Kruus, M.; Meigas, K. (2012). A Benchmark Suite for Evaluating the Efficiency of Test Tools. *The 13th Biennial Baltic Electronics Conference (BEC2012)*. TTU Press, 2012. [ilmumas]

Tomson, R.; Fridolin, I.; Uhlin, F.; Holmar, J.; Lauri, K.; Luman, M. (2012). Development of the Model for the Optical Monitoring of Urea in Spent Dialysate. In: *Proceedings of the 13th Biennial Baltic Electronics Conference: 13th Biennial Baltic Electronics Conference, Tallinn, Estonia, October 3 - 5, 2012.*, 2012, 179 - 182.

Pilt, Kristjan; Meigas, Kalju; Temitski, Kristina; Viigimaa, Margus (2012). Second derivative analysis of forehead photoplethysmographic signal in healthy volunteers and diabetes patients. In: *IFMBE Proceedings: World Congress on Medical Physics and Biomedical Engineering, Peking, 26-31 Mai 2012*. IFMBE, 2012, 410 - 413.

3.2

Parv, L.; Saluse, J.; Aaviksoo, A.; Tiik, M.; Sepper, R.; Ross, P. (2012). Economic Impact of a Nationwide Interoperable e-Health system Using the PENG Evaluation Tool. J. Mantas, S. Kjær Andersen, M. Christina Mazzoleni, B. Blobel, S. Quaglini, A. Moen (Toim.). *Quality of Life through Quality of Information - Proceedings of MIE2012* (876 - 880).IOS Press

3.3

4.1

5.1

Arund, J.; Tanner, R.; Fridolin, I.; Luman, M. (2012). Impact of paracetamol on optical on-line dialysis monitoring and on uricemia. *Nephrology, Dialysis, Transplantation*, 27(suppl 2), ii197 - ii226.

Pshenichnikov, I.; Shipilova, T.; Kaik, J. (2012). Impact of myocardial electrical instability parameters, arterial hypertension, and main cardiovascular risk factors on cardiovascular mortality and morbidity of Tallinn women. 22nd European Meeting on Hypertension and Cardiovascular Protection. London, April 26 - 29. *Journal of Hypertension*, Volume 30, e-Supplement A., 2012, e470 - e470.

Shipilova, Tatjana; Pshenichnikov, Igor; Karai, Dmitri; Kaik, Jüri (2012). Non-dipping Pattern of Heart Rate in Relation to Target Organ Damage in Women with Uncontrolled Essential Hypertension. 22nd European Meeting on Hypertension and Cardiovascular Protection. London, April 26-29. *Journal of Hypertension*, Volume 30, e-Supplement A., 2012, e222 - e222.

2.9 Struktuuriüksuses kaitstud doktoriväitekirjade loetelu (*NB! struktuuriüksus lisab struktuuriüksuse töötaja juhendamisel mujal kaitstud doktoriväitekirjade loetelu*)

Madis Tiik, TTÜ Tehnomeedikum

Teema: *Access Rights and Organizational Management in Implementation of Estonian Electronic Health Record System* (Pääsuõiguste ja organisatsiooniliste meetmete rakendamine Eesti tervise infosüsteemi näitel)

Juhendajad: dotsent Peeter Ross ja prof Heidi-Ingrid Maaroo

Kaitses: 14.12.2012

Omistatud kraad: filosoofiadoktor (tervishoiutehnoloogia)

2.10 Struktuuriüksuses järeldoktorina T&A-s osalenud isikute loetelu (*ETIS-e kaudu esitatud taotluste alusel*)

Illumets Helen, Biomarkers for smoking related early airway inflammation with special focus on protease-antiprotease imbalance (1.01.2013 - 31.12.2015)

2.11 Struktuuriüksuses loodud tööstusomandi loetelu

US13/807,688

Device and method for middle and protein bound uremic toxins measurements in the biological fluids

Taotlus esitatud: 28.12.2012

Autorid: Ivo Fridolin, Fredrik Uhlin, Jana Holmar, Risto Tanner, Jürgen Arund.

Omanik: TTÜ

BR2012 (Brasiilia patenditaotluse number täpsustamisel)

Device and method for middle and protein bound uremic toxins measurements in the biological fluids

Taotlus esitatud: 28.12.2012

Autorid: Ivo Fridolin, Fredrik Uhlin, Jana Holmar, Risto Tanner, Jürgen Arund.

Omanik: TTÜ

CN2012 (Hiina patenditaotluse number täpsustamisel)

Device and method for middle and protein bound uremic toxins measurements in the biological fluids

Taotlus esitatud: 28.12.2012

Autorid: Ivo Fridolin, Fredrik Uhlin, Jana Holmar, Risto Tanner, Jürgen Arund.

Omanik: TTÜ

JP2012 (Jaapani patenditaotluse number täpsustamisel)

Device and method for middle and protein bound uremic toxins measurements in the biological fluids

Taotlus esitatud: 21.12.2012

Autorid: Ivo Fridolin, Fredrik Uhlin, Jana Holmar, Risto Tanner, Jürgen Arund

Omanik: TTÜ

US13/700,440

Optical method and device for quantitative concentration measurements of compounds in the biological fluids

Taotlus esitatud: 27.11.2012

Autorid: Ivo Fridolin, Jana Holmar, Kai Lauri, Merike Luman

Omanik: TTÜ

EP11741089.4

Optical method and device for quantitative concentration measurements of compounds in the biological fluids

Taotlus esitatud: 25.12.2012

Autorid: Ivo Fridolin, Jana Holmar, Kai Lauri, Merike Luman

Omanik: TTÜ

US8244341B1

Method and device for determining depressive disorders by measuring bioelectromagnetic signals of the brain

Patent välja antud: 14.08.2012

Autorid: Hiie Hinrikus, Maie Bachmann, Jaanus Lass, Anna Suhhova, Viiu Tuulik, Kaire Adamsoo, Ülle Võhma.

Omanikud: TTÜ, SA PERH

3. Struktuuriüksuse infrastruktuuri uuendamise loetelu (*summa eurodes*)

PV007483, Card(X)plore recorder package, 12.11.2012 (3 498,00)

PV007521, Oscilloscope,2-channel, 18.12.2012 (6 757,50)

PV007335, Kopsude välishingamisfunkts., 13.03.2012 (42 380,00)