



INSTITUTE OF MOLECULAR AND CELL BIOLOGY

University of Tartu



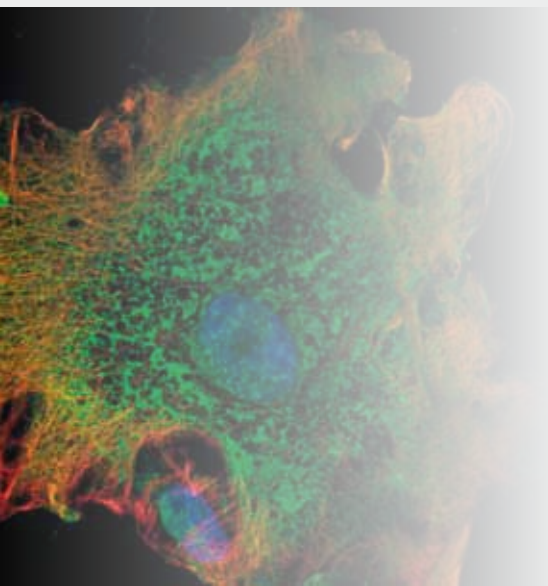
2010

INSTITUTE OF MOLECULAR AND CELL BIOLOGY

UNIVERSITY OF TARTU

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FOREWORD



INSTITUTE OF MOLECULAR AND CELL BIOLOGY, UNIVERSITY OF TARTU 1990–2010

The Institute of Molecular and Cell Biology (IMCB) was founded by the decree of rector prof J. Kärner as a new centre of teaching and research. This was based on the agreement between Tartu State University and Estonian Academy of Sciences and on the decision of the University Council from the 1st of June 1990. The university gave the building Riia Street 23 to the institute from the 25th of July 1990 and the IMCB was registered as a legal entity inside university from the 31st of August 1990. The legal status of the IMCB was remitted August 29, 1996 by the decree of rector prof. P. Tulviste, based on the decision of University Council.

Due to the teaching responsibilities the name of the IMCB was also changed (01.10.1990) for a short period to the Chair-Institute of Molecular and Cell Biology. From September 1st 1990 Tartu University included by the decree of the rector (from November 29th 1990) to the structure of the IMCB from the Faculty of Biology and Geography the Chair of genetics and cytology and from the sector of molecular biology (headed by prof Artur Lind) of the department of research of the university the laboratories of plasmid biology (Ain Heinaru), laboratory of gene expression (Andres Metspalu), laboratory of oncogenesis (Mart Ustav) and the sector of embryonal histogenesis. In 1991 the university initiated the reconstruction of the Riia 23 building. This activity was supported by Tartu City Council decision to give additionally 0,3 ha of neighbouring land to Riia 23 (altogether 5627 m²) and the decision of the Estonian Academy of Sciences (05.07.1991) to co-finance the renovation.

The renovation of the building Riia Street 23 was completed in 1994. By this time the IMCB consisted of 8 chairs headed by professors (Genetics – prof. Ain Heinaru, Cell Biology – prof. Toivo Maimets, Molecular Biology – prof. Richard Villems, Microbiology and Virology – prof. Mart Ustav, Biotechnology – prof. Andres Metspalu, Evolutionary Biology – prof. Henni Kallak, Plant Physiology – prof. Agu Laisk, General and Microbial Biochemistry – prof. Peep Palumaa). In the building of Riia 23 also the laboratory of molecular genetics (headed by prof. Mart Saarma) of the Institute of Biological and Physical Chemistry and the Estonian Biocentre (director Richard Villems) were situated. The chair of plant physiology got rooms in the building Soinaste Street 181 and biochemistry in Vanemuise Street 46. These chairs were organised from the Chair of Plant Physiology and Biochemistry of the Faculty of Biology and Geography. Several key researchers from the Institute of General and Molecular Pathology of Tartu University also joined the IMCB.

As a private donation (Citrina Foundation, U.K.) a new building (Riia Street 23b) was built, rooms for practical courses for students were renovated and equipped (2007, Helgi Nirk, Australia) and the building Riia Street 23 got the second floor (2004, Phare). On the basis of the researchers and graduates of the IMCB the Estonian Genome Project was founded in 2001 (since 2009 Estonian Genome Center). In 2007 it became the institute of Tartu University. In 2001 the Institute of Technology of Tartu University (first director prof. Mart Ustav) was founded. At the same time the Department of Gene Technology started in Tallinn Technical University. 15 biotech companies have been set up on the basis of the IMCB.

Professor Ain Heinaru
first Director of the Institute

FOREWORD

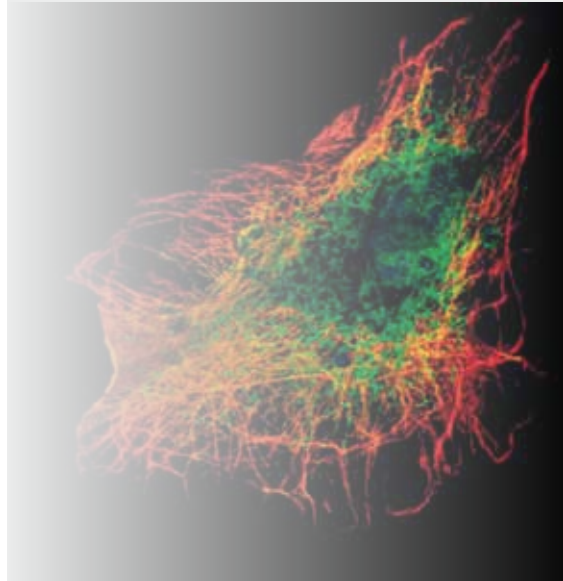
WORKING TODAY FOR THE FUTURE OF IMCB

Today, 20 years after foundation of the Institute of Molecular and Cell Biology, University of Tartu, we can all see that the best wishes and plans of the founders have been greatly fulfilled and new perspectives for the future have been designed and being followed. The IMBC publishes about one sixth of all research papers of the University of Tartu and awards every tenth Ph.D degree of the University. Our researchers are successful in grant competitions in Estonia and abroad. Many biotech SME-s have been grown out from the IMBC, some of them already with good international reputation. The researchers and teachers of the IMBC take actively part in designing, governing and managing strategic issues of research and society both nationally and internationally. Several new research institutions have been created from the IMBC, which all in one way or another develop and deepen the different activities (research, innovation, technological development etc.) of the IMBC, thereby positively contributing to the overall development of the field of molecular and cell biology.

Thanks to the enthusiastic and professional people working at the Institute, I as a director can find many good reasons to be optimistic for the next decades to come. As before, in the future we will certainly use the main strength of our institute – IMCB is an institution, where there is a real and fully functioning integration between teaching, internationally recognized high-level research and technological development and innovation. In the field of teaching it is especially important to underline the fact that IMBC has since its very beginning performed teaching at all three academic levels – bachelor, MSc and PhD studies. This will create a constant flow of new talented young people, who want and are able to become good scientists. Our Graduate School, in turn, has now created good conditions to optimally use all the resources for that. Every year our people open new strategically important directions of research and are successful in ensuring their development in the conditions of tight international competition. Competition, of course, comes together with collaboration and I think we have mostly found good balance between the two. And last but not least – the age composition of the people working for the IMBC is quite optimal, which in turn allows smooth turnover of generations and guarantees a long and bright future for this Institute.

Vivat!

Professor Toivo Maimets
Director



DIRECTORS

THE DIRECTORS OF THE INSTITUTE OF MOLECULAR AND CELL BIOLOGY



Ain Heinaru
28.09.1990 – 31.12.1995

Mart Ustav
01.01.1996 – 06.09.1999
(periodically suspended)



Alar Karis
06.03.1998 – 31.08.1998
(within the period of M.Ustav)

Richard Villems
01.01.1999 – 30.04.1999
(within the period of M.Ustav)



Toivo Maimets
07.09.1999 – 09.04.2003

Jaanus Remme
10.04.2003 – 01.06.2003

Richard Villems
02.06.2003 – 31.08.2003

Juhan Sedman
02.09.2003 – 31.12.2007

Toivo Maimets
01.01.2008 – ...



CHAIR OF BIOINFORMATICS

Professor Mairo Remm
PhD, Head of the Chair

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Research:

The chair of bioinformatics uses computational tools to analyse biological data. Novel experimental data (sequence, genotype and PCR data) is frequently generated in collaboration with other workgroups.

The main directions of research in the chair of bioinformatics are the following:

- studying genetic variations in the human genome;
- statistical modeling of DNA-DNA interactions in genomes in order to predict PCR outcome in various conditions;
- comparative genomics studies in bacteria.

Some current topics of the studies in our chair:

How frequent are DNA Copy-Number-Variations in human genome and how are they inherited from parents to children?

How frequent are fragments of DNA viruses in human genome?

What genes in the human genome are significantly different between different populations?

How deeply can we reconstruct family trees, based on the genome sequences of individuals?

How to find the best pair of PCR primers for detection of pathogenic bacteria?

What signals in genes and proteins determine the protein expression levels and it's sensitivity to antibiotics?

What is the evolutionary history of bacterial translational GTP-ase genes?

Lecture courses:

LOMR.10.002 Bioinformatics I
LOMR.10.005 Bioinformatics II
LOMR.10.004 Genomics
LOMR.00.058 Seminars in bioinformatics

Personnel of the chair:

Teaching and research:

Mairo Remm, Professor, PhD
Tõnu Möls, cand., Senior Scientist
Reidar Andreson, PhD, Research Scientist
Reedik Mägi, PhD, Research Scientist
Priit Palta, MSc, Research Scientist
Age Tats, PhD, Research Scientist
Märt Möls, Extraordinary Scientist
Silja Laht, Extraordinary Scientist

PhD students:

Tarmo Puurand
Triinu Kõressaar
Lauris Kaplinski
Tõnu Margus
Aleksander Sudakov

MSc students:

Berit Peeters
Ksenja George

Support:

Oliivika Zeiger, Assistant
Mikk Eelmets, Programmer
Andres Veidenberg, Programmer

Publications:

■ Dawson E, Abecasis GR, Bumpstead S, Chen Y, Hunt S, Beare DM, Pabial J, Dibbling T, Tinsley E, Kirby S, Carter D, Papaspyridonos M, Livingstone S, Ganske R, Lohmussaar E, Zernant J, Tonisson N, Remm M, Magi

R, Puurand T, Vilo J, Kurg A, Rice K, Deloukas P, Mott R, Metspalu A, Bentley DR, Cardon LR and Dunham I. A first-generation linkage disequilibrium map of human chromosome 22. *Nature*, 2002; 418:544-548

■ Andreson R, Möls T, Remm M. Predicting failure rate of PCR in large genomes. *Nucleic Acids Research*, 2008 Jun;36(11):e66

■ Kõressaar T, Remm M. Enhancements and modifications of primer design program Primer3. *Bioinformatics*, 2007 May 15; 23(10):1289-91

■ Kõressaar T, Jõers K, Remm M. Automatic identification of species-specific repetitive DNA sequences and their utilization for detecting microbial organisms. *Bioinformatics*, 2009 April; 25(11):1349-1355

■ Tats A, Tenson T, Remm M. Preferred and avoided codon pairs in three domains of life. *BMC Genomics*, 2008 Oct 8;9(1):463

■ Margus T, Remm M and Tenson T. Phylogenetic distribution of translational GTPases in bacteria. *BMC Genomics*, 2007 Jan 10; 8:15



CHAIR OF BIOPHYSICS AND PLANT PHYSIOLOGY

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Fundamental photosynthesis processes are investigated on various integration levels, from purified antenna and reaction centre complexes through intact leaves and whole plants.

Key words:

Modelling of photosynthesis; light utilization in plant photosystems I and II; regulation of electron/proton transport; linear and cyclic electron transport in photosystem I; CO₂ assimilation in photosynthesis and separation in respiration; regulation of RUBISCO activity in plant leaves; relationships between the carbon and nitrogen reduction in photosynthesis; molecular mechanisms of photosynthesis; fine tuning of the antenna spectra; selective spectroscopy of biomolecules; stability of integral membrane proteins; high-pressure spectroscopy of biomolecules; optical tweezing of biomolecules.

Lecture courses:

LOMR.07.003 Bioenergetics
LOMR.07.005 Biological Physics
LOMR.06.004 Cell Biology I
LOMR.07.006 Laboratory Plant Physiology
LOMR.07.002 Plant Biochemistry
LOMR.07.001 Plant Physiology

RESEARCH GROUP OF LEAF PHOTOSYNTHESIS

Senior Scientist Agu Laisk
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Research group:

Agu Laisk, DSc, Member of the Estonian Academy of Sciences, Senior Research Fellow, Head of the Group
Vello Oja, PhD, Senior Scientist
Evi Padu, PhD, Associate Professor
Bahtijor Rasulov, DSc, Senior Scientist

Eero Talts, PhD, Scientist
Irina Bichele, MSc, Scientist
Hillar Eichelmann, MSc, Scientist
Heikko Rämna, Engineer

Current projects:

■ **Plant leaf photosynthesis: limitation, regulation and adaptation.** Target project SF 01800045s08, 2008–2013, SF0180055s07 of the Estonian Ministry of Education and Research.
■ **Balancing assimilatory and reducing power during photosynthesis – the role of cyclic and alternative electron flows.** Grant project ETF 8283 for 2010–2013 from Estonian Science Foundation.

■ **Apparatus for investigation of photosynthesis: LED light sources, pulsed spectrophotometer, plant chambers, operating program.** Grant project ETF 8344 for 2010–2013 from Estonian Science Foundation.

Selected publications:

■ Laisk A, Talts E, Oja V, Eichelmann H and Peterson R. Fast cyclic electron transport around photosystem I in leaves under far-red light: a proton-uncoupled pathway? *Photosynth Res* 103: 79-95, (2010)

■ Rasulov B, Copolovici L, Laisk A and Niinemets Ü. Postillumination isoprene emission: in vivo measurements of dimethylallyldiphosphate

pool size and isoprene synthase kinetics in aspen leaves. *Plant Physiol* 149: 1609-1618 (2009)

■ Eichelmann H, Talts E, Oja V, Padu E and Laisk A Rubisco in planta kcat is regulated in balance with photosynthetic electron transport. *J. Exp. Bot.* 60: 4077-4088 (2009)

■ Laisk A, Eichelmann H and Oja V. Leaf C3 photosynthesis in silico: integrated carbon/nitrogen metabolism. In: Laisk A, Nedbal L and Govindjee (eds) *Photosynthesis in silico: understanding complexity from molecules to ecosystems* pp. 295-322. Springer Science+Business Media B.V., The Netherlands. (2009)

■ Laisk A, Eichelmann H, Oja V, Talts E and Scheibe R. Rates and roles of cyclic and alternative electron flow in potato leaves. *Plant Cell Physiol.* 48: 1575-1588 (2007)

BIOPHYSICS LABORATORY, INSTITUTE OF PHYSICS, UNIVERSITY OF TARTU

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Research group:

Arvi Freiberg, DSc, Member of the Estonian Academy of Sciences, Head of the Laboratory
Margus Rätsep, PhD, Senior Scientist
Kõu Timpmann, PhD, Senior Scientist
Erko Jalviste, PhD, Scientist
Veera Krasnenko, PhD, Scientist
Kristjan Leiger, PhD, Scientist
Liina Kangur, MSc, Scientist
Hain Salujärvi, Specialist
Mikk Välbe, PhD student

Current projects:

Physical studies of biologically relevant molecules and molecular complexes. Target Project SF0180055s07 of the Estonian Ministry of Education and Research.

Spectral fine-tuning mechanisms in self-organized molecular complexes and light-energy conversion systems. Estonian Science Foundation Grant 7002.

Design and function of self-assembled light-energy conversion devices. European Science Foundation COST D35 Working Group 0015-05 Project.

The electronically excited states of pigment-protein complexes from photosynthetic purple bacteria-test of the self trapped exciton model. Deutsche Forschungsgemeinschaft Project GZ: 436 EST 113/4/0-1.

Selected Publications:

■ M. Rätsep, J. Linnanto, A. Freiberg, "Mirror symmetry and vibrational structure in optical spectra of chlorophyll a," *J. Chem. Phys.* 130, pp. 194501, 2009.

■ A. Freiberg, M. Rätsep, K. Timpmann, G. Trinkunas, "Excitonic polarons in quasi-one-dimensional LH1 and LH2 bacteriochlorophyll a antenna aggregates from photosynthetic bacteria: A wavelength-dependent selective spectroscopy study," *Chem. Phys.* 357, pp. 102-112, 2009.

■ A. Freiberg, G. Trinkunas, "Unraveling the hidden nature of antenna excitations," In: *Photosynthesis in Silico. Understanding Complexity from Molecules to Ecosystems*, Ed. by A. Laisk, L. Nedbal, Govindjee Springer, pp. 55-82, 2009.

■ L. Kangur, K. Timpmann, A. Freiberg, "Stability of integral membrane proteins under high hydrostatic pressure: The LH2 and LH3 antenna pigment-protein complexes from photosynthetic bacteria," *J. Phys. Chem. B* 112, pp. 7948-7955, 2008.

■ M. Rätsep, J. Pieper, K.-D. Irrgang, A. Freiberg, "Excitation wavelength-dependent electron-phonon and electron-vibrational coupling in the CP29 antenna complex of green plants," *J. Phys. Chem. B* 112, pp. 110-118, 2008.



CHAIR OF BIOTECHNOLOGY

Professor Andres Metspalu
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Lecture courses:

LOMR.01.001 Molecular Biotechnology
LOMR.01.002 Structure and Function of the Genome
LOMR.01.003 Practical Trainings in Molecular Biotechnology
LOMR.01.004 Cytogenetics
LOMR.01.005 Human Genetics
LOMR.00.078 Entrepreneurship in Biotechnology

RESEARCH GROUP OF BIOTECHNOLOGY

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The Chair of Biotechnology was established in 1992 based on the Gene Expression laboratory of the Institute of General and Molecular Pathology at Tartu University. Starting with one professor (A. M.), the chair has now given rise to new professors (A. Kurg, M. Laan, and A. Salumets) who head different scientific topics and supervise under- and post-graduate students. In addition, the chair has also led to the establishment of the Estonian Genome Center of Tartu University and the Center for Molecular Diagnostics of Tartu University Clinic. Our research has focused on two main topics: a) Development of microarray technology for gene analysis and its application in molecular diagnostics; b) Human genome variability and phenotypic diversity. Both efforts have been competitive on an international level and have been cited in books (Strachan & Read, Human Molecular Genetics 3) and in over 200 peer-reviewed articles. Over the past 15 years the Chair of Biotechnology has provided a research ground for 15 young scientists who have defended their doctoral thesis. The research is performed in close collaboration with

the Chairs of Evolutionary Biology and Bioinformatics, as well as with the Estonian Genome Center of Tartu University and the Estonian Biocenter, which all together form the Center of Excellence in Genomics. The research has been funded by the Estonian Science Foundation, Target Financing from the Estonian Government, Enterprise Estonia, European framework programs, and other agencies.

Research group:

Professor **Andres Metspalu**

Senior Scientists:

Neeme Tõnisson, Tarmo Annilo, Cheng Luo

Scientists: Tiit Nikopensius, Mari Nelis, Kristi Kallassalu, Maris Teder-Laving, Chelsea Ann Stern

Techicians: Heidi Saulep, Viljo Soo
PhD students: Evelin Mihailov, Kristjan Välk, Tõnu Vooder, Kaarel Krjutškov, Egon Urgard, Eva Reinmaa, Anu Tammiste, Kaie Kirotar, Tõnu Esko, Aune Ahman

Master students: Triin Viltrop, Marina Solovjova, Andres Kutsar, Urmo Võsa

Undergraduates: Pille Pihlakas, Mari-Liis Reim, Vidrik Teder, Hindrek Teder, Martin Tootsi

Project Manager of EU Grants Merike Leego

Secretary Krista Liiv

Selected publications:

■ Common variants in KCNN3 are associated with lone atrial fibrillation. Patrick T Ellinor, Kathryn L Lunetta, et.al. [IMCB co-authors: Mari Nelis, Tõnu Esko, Andres Metspalu] Nature Genetics 2010 Mar;42(3):240-4

■ CLOCK Gene Variants Associate with Sleep Duration in Two Independent Populations. Karla V. Allebrandt, Maris Teder-Laving, Mahmut Akyol, Irene Pichler, Bertram Müller-Myhsok,



Peter Pramstaller, Martha Merrow, Thomas Meitinger, Andres Metspalu, and Till Roenneberg BIOL PSYCHIATRY (2010);xx:xxx, doi:10.1016/j.biopsych.2009.12.026

■ A new highly penetrant form of obesity due to deletions on chromosome 16p11.2

R. G. Walters, S. Jacquemont, et al. [IMCB co-authors: A. Kurg, P. Palta, T. Esko, A. Metspalu, M. Nelis, K. Männik] Nature 463, 671-675 (4 February 2010)

■ A Genome-wide Association Study of Lung Cancer Identifies a Region of Chromosome 5p15 Associated with Risk for Adenocarcinoma.

Maria Teresa Landi, Nilanjan Chatterjee, et al. [IMCB co-authors: Andres Metspalu, Tonu Vooder, Mari Nelis, Kristian Välik], The American Journal of Human Genetics (2009) 85(5), 679-691.

■ Genetic Structure of Europeans: a view from the North-East.

Mari Nelis, Tõnu Esko, Reedik Mägi, et al. PlosOne 2009, <http://dx.plos.org/10.1371/journal.pone.0005472>

■ Development of a single tube 640-plex genotyping method for detection of nucleic acid variations on microarrays. Kaarel Krjutškov, Reidar Anderson, Reedik Mägi, Tiit Nikopensus, Andrey Khrunin, Evelin Mihailov, Veronika Tammekivi, Helena Sork, Mairo Remm, Andres Metspalu. Nucleic Acids Res. (2008) Jul;36(12):e75. Epub 2008 Jun 5.

■ The first generation linkage disequilibrium and haplotype map of chromosome 22 in Caucasians. Dawson, E, Abecasis, G.R, Bumpstead, S, Chen, Y, Hunt, S, et al., (2002) Nature 418: 544-548.

RESEARCH GROUP OF MOLECULAR BIOTECHNOLOGY

Professor Ants Kurg
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Key words in research:

Human DNA copy-number variations and other structural aberrations in healthy individuals and patients with developmental anomalies, molecular karyotyping, whole-genome genotyping, genotype-phenotype correlations; novel genomic regions and candidate genes associated with mental retardation phenotype.

The development of novel micro- and nanotechnological solutions and microresonator-based biosensor technology for detection and identification of different bacteria, using tmRNA as detection marker.

Research group:

Prof. Ants Kurg, PhD, Head of the Group
Katrin Männik, MSc, Researcher
Sven Parkel, PhD, Extraordinary Researcher
Olga Žilina, MSc, Extraordinary Researcher
Eve Öiglane-Šlik, MD, PhD, Extraordinary Researcher
Merle Külaots, Senior Technician
Ott Scheler, PhD student, Tõnu Esko, PhD, student, Liisi Võsa, PhD, student
Margit Nõukas, Polina Zjablovskaja, Kristo Kuus, Master students
Olga Tšuiiko and Steven Smit, Undergraduate students

Selected publications:

■ Kurg A, Tõnisson N, Georgiou I, Shumaker J, Tollett J, et al., (2000) Arrayed Primer Extension: Solid phase four-color DNA resequencing and mutation detection technology. Genetic Testing 4: 1-7.

■ Patsalis, P.C., Kousoulidou, L., Männik, K., Sismani, C., Žilina, O., et al., (2007) Detection of small genomic imbalances using microarray-based multiplex amplifiable probe hybridization. Eur J Hum Genet. 15: 162-172.



■ Kousoulidou L, Männik K, Sismani C, Zilina O, Parkel S, et al., (2008) Array-MAPH: a methodology for the detection of locus copy-number changes in complex genomes. *Nat Protoc.* 3(5):849-65.

■ van Bon, B.V.M., Mefford, H.C., Menten, B., Koolen, D.A., Sharp, A.J., et al., (2009) Further delineation of the 15q13 microdeletion and duplication syndromes: A clinical spectrum varying from non-pathogenic to a severe outcome, *J Med Genet.* Aug;46(8):511-523

■ Scheler O, Glynn B, Parkel S, Palta P, Toome K, et al., (2009) Fluorescent labeling of NASBA amplified tmRNA molecules for microarray applications. *BMC Biotechnol.* May 15;9(1):45.

■ Walters RG, Jacquemont S, Valsesia A, de Smith AJ, Martinet D, et al., (2010) A new highly penetrant form of obesity due to deletions on chromosome 16p11.2 *Nature.* Feb 4;463(7281):671-5

RESEARCH GROUP OF HUMAN MOLECULAR GENETICS

Professor Maris Laan
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E-mail: maris.laan@ut.ee or maris@ebc.ee

Research:

Our group's research interests are targeted to understand the inheritable component of human complex traits, with the emphasis on reproductive and cardiovascular system.

Specific topics:

Genome dynamics of duplicated genes;

Gonadotropin beta and growth hormone/placental lactogen gene-families associated with reproductive success;

Genetic component of blood pressure and related traits addressed by genome-wide and candidate gene based approaches;

Genomics, genetics and differential placental gene expression in normal, complicated and failed pregnancy.

Research group:

Senior Scientists: Elin Org, Jaana Männik

Scientists: Pille Hallast, Kristiina Rull, Gudrun Veldre

Post-Doc: Yanina Timasheva

PhD Students: Katrin Kepp, Liina Nagirnaja, Siim Sõber, Marina Grigorova, Liis Uusküla, Margus Putku, Peeter Juhanson

Laboratory Specialist: Piret Kelgo

Other lab-members: 6 (Msc, Bsc students; technical staff)

Core publications of the group:

a) Genomics of duplicated genes:

■ Hallast, P., Nagirnaja, L., Margus, T., Laan, M. (2005) Segmental Duplications and Gene Conversion: Human Luteinizing Hormone/ Chorionic Gonadotropin Beta Gene Cluster. *Genome Res* 15: 1535-1546.

■ Sedman L, Padhukasahasram B, Kelgo P, Laan M (2008) Complex Signatures of Locus-Specific Selective Pressures and Gene Conversion on



Human Growth Hormone/Chorionic Somatomammotropin Genes. *Hum Mutat* 29(10): 1181 – 1193.

■ Hallast P, Saarela J, Palotie A, Laan M (2008) High divergence in primate-specific duplicated regions: Human and chimpanzee Chorionic Gonadotropin Beta genes *BMC Evol Biol* 8(195): 1 – 14.

b) Reproductive genetics:

■ Rull K, Nagirnjaja L, Ulander V-M, Kelgo P, Margus T, Kaare M, Ait-tomäki K, Laan M (2008) Chorionic Gonadotropin Beta gene variants are associated with recurrent miscarriage in two European populations. *J Clin Endocrinol Metab* 93(12): 4697 – 4706.

■ Grigorova M, Punab M, Poolamets O, Kelgo P, Ausmees K, Korrovits P, Vihljajev V, Laan M (2010) Increased Prevalance of the 211 T Allele of Follicle Stimulating Hormone (FSH) Subunit Promoter Polymorphism and Lower Serum FSH in Infertile Men. *J Clin Endocrinol Metab* 95(1):100-8.

■ Männik J, Vaas P, Rull K, Teesalu P, Rebane T, Laan M (2010) Differential Expression Profile of Growth Hormone/Chorionic Somatomammotropin Genes in Placenta of Small- and Large-for-Gestational-Age Newborns. *J Clin Endocrinol Metab*. 2010 Mar 16. [Epub ahead of print]

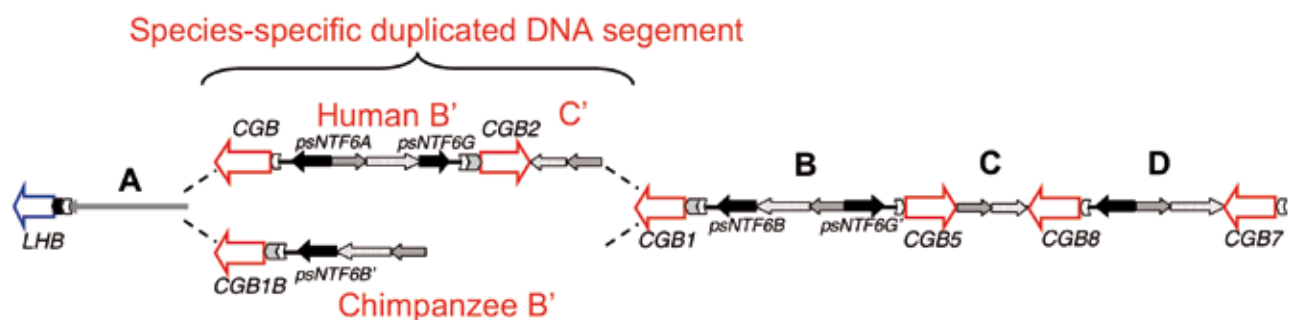
c) Blood pressure genetics:

■ Org E, Eyheramendy S, Juhanson P, Gieger C, Lichtner P, Klopp N, Veldre G, Döring A, Viigimaa M, Söber S, Tomberg K, Eckstein G, KORA, Kelgo P, Rebane T, Shaw-Hawkins S, Howard P, Onipinla A, Dobson RJ, Newhouse SJ, Brown M, Dominiczak A, Connell J, Samani N, Farrall M, BRIGHT, Caulfield M, Munroe PB, Illig T, Wichmann HE, Meitinger T, Laan M (2009) Genome-wide scan identifies CDH13 as a novel susceptibility locus contributing to blood pressure determination in two European populations. *Hum Mol Genet* 18: 2288-2296

■ Söber S, Org E, Kepp K, Juhanson P, Eyheramendy S, Gieger C, Lichtner P, Klopp N, Veldre G, Viigimaa M, Döring A, Putku M, Kelgo P, Shaw-Hawkins S, Howard P, Onipinla A, Dobson RJ, Newhouse SJ, Brown M, Dominiczak A, Connell J, Samani N, Farrall M, Caulfield M, Munroe PB, Illig T, Wichmann HE, Meitinger T, Laan M (2009) Targeting 160 candidate genes for blood pressure regulation with a genome-wide genotyping array. *PLoS ONE* 4(6): e6034, 1-13

d) Participation in international GLOBAL Bpgen consortium:

■ Global Bpgen consortium (2009) Eight blood pressure loci identified by genomewide association study of 34,433 people of European ancestry. *Nature Genet* 41: 666 – 676. [IMCB co-authors: Elin Org, Maris Laan]



Comparative structures of human and chimpanzee LHB/CGB gene clusters. Modified from Hallast et al (2008) *BMC Evol Biol* 8: 1 – 14

CHAIR OF CELL BIOLOGY

Professor Toivo Maimets
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The research of the chair is carried out in four groups:

RESEARCH GROUP IN STEM CELLS

Professor Toivo Maimets
PhD, Head of the Group

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Key words:

Human embryonic stem cells, control of the cell cycle, expression of pluripotency markers, tumor connected signalization paths in stem cells.

Research group:

Toivo Maimets, Professor, PhD
Sulev Ingerpuu, Associate Professor, PhD
Viljar Jaks, Extraordinary Scientist, PhD
Ade Kallas, Scientist, Dr., pharm.

Martin Pook, PhD Student
Martti Maimets, PhD Student
Elo Madissoo, MSc Student
Maili Zimmermann, Laboratory Assistant
Küllli Zimmermann, Laboratory Assistant

CHROMATIN RESEARCH GROUP

Senior Scientist Arnold Kristjuhan
PhD, Head of the Group

Riia 23b-234, Tartu
Phone: +372-7375046
E-mail: arnold.kristjuhan@ut.ee

Key words:

Chromatin, nucleosomes, histone modifications, mRNA transcription, DNA replication.

We are studying the role of chromatin remodelling, nucleosome dynamics and histone modifications in regulation of mRNA transcription and DNA replication in eukaryotic cells.

Research group:

Arnold Kristjuhan, Senior Scientist, PhD
Marko Lööke, PhD Student
Signe Värvi, PhD Student
Kadri Peil, PhD Student
Keiu Paapsi, PhD Student

Lari Järvinen, MSc Student
Henel Sein, MSc Student
Maia-Liisa Anton, MSc Student
Kersti Kristjuhan, Laboratory Assistant

RESEARCH GROUP IN CANCER-ASSOCIATED SIGNALING PATHWAYS

Scientist Lilian Kadaja-Saarepuu
PhD, Head of the Group

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E-mail: lilian.kadaja@ut.ee

Research interests:

- impact of tumor suppressor protein p53 on the expression and cellular localization of CD43;
- cell density dependence of CD43 and beta-catenin expression;
- Wnt signaling and CD43 in tumor cells and human embryonic stem cells.

Research group:

Lilian Kadaja-Saarepuu, Scientist, PhD
Janeli Viil, PhD Student
Anna Balikova, PhD Student
Julia Nesterova, MSc Student
Kirill Jefimov, Kaisa Külaots, Ivo Kändla, Undergraduate Students



RESEARCH GROUP IN BIOLOGY OF DIOXIN RECEPTOR (AHR)

Extraord. Scientist Tarmo Tiido
PhD, Head of the Group

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Phone: +372-7376098
E-mail: tarmo.tiido@ut.ee

Research interests:

the role of dioxin receptor in reproductive function; mechanisms of cellular signaling mediated by ligand-activated AHR.

Research group:

Tarmo Tiido, Extraord. Scientist, PhD
Indrek Teino, MSc Student
Asko Kriiska, Undergraduate Student

Lecture courses:

LOMR.06.001 Molecular Cell Biology
LOMR.06.002 Culture of Animal Cells
LOMR.06.005 Cell Biology II
LOMR.08.007 Yeast Genetics
LOMR.06.003 Practical Course in Cell Biology

Publications:

■ Värvi S, Kristjuhan K, Peil K, Lõoke M, Mahlakõiv T, Paapsi K, Kristjuhan A. Acetylation of H3 K56 Is Required for RNA Polymerase II Transcript Elongation through Heterochromatin in Yeast. *Mol Cell Biol.* 2010, 6, 1467-1477.

■ Maimets T, Neganova I, Armstrong L, Lako M. Activation of p53 by nutlin leads to rapid differentiation of human embryonic stem cells. *Oncogene.* 2008, 27, 5277-5287.

■ Kadaja-Saarepuu L, Laos S, Jääger K, Viil J, Balikova A, Lõoke M, Hansson GC, Maimets T. CD43 promotes cell growth and helps to evade FAS-mediated apoptosis in non-hematopoietic cancer cells lacking the tumor suppressors p53 or ARF. *Oncogene.* 2008, 27, 1705-1715.

■ Johansson HJ, El-Andaloussi S, Holm T, Mäe M, Jänes J, Maimets T, Langel U. Characterization of a novel cytotoxic cell-penetrating peptide de-



Colonies of budding yeast (*S. cerevisiae*) on solid media plate

rived from p14ARF protein. *Mol Ther.* 2008, 16, 115-123.

■ Jaks V, Barker N, Kasper M, van Es JH, Snippert HJ, Clevers H, Toftgård R. Lgr5 marks cycling, yet long-lived, hair follicle stem cells. *Nat Genet.* 2008, 40, 1291-1299.

■ Värvi S, Kristjuhan K, Kristjuhan A. RNA polymerase II determines the area of nucleosome loss in transcribed gene loci. *Biochem Biophys Res Commun.* 2007, 358, 666-671.

■ Tiido T, Rignell-Hydbom A, Jönsson BA, Rylander L, Giwercman A, Giwercman YL. Modifying effect of the AR gene trinucleotide repeats and SNPs in the AHR and AHRR genes on the association between persistent organohalogen pollutant exposure and human sperm Y:X ratio. *Mol Hum Reprod.* 2007, 4, 223-229.

CHAIR OF DEVELOPMENTAL BIOLOGY

Professor Margus Pooga
PhD, Head of the Chair

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mpooga@ebc.ee

The research in the chair is focussed on the studies of early development in mammals. The main emphasis is given to:

- function of GATA-family transcription factors in the development of brain, ear, heart and urogenital system in mouse;
- role of nucleotide exchange factor Ric8 in early development and in the nervous system;
- genes related to neurodegeneration and ageing in *C. elegans* model;
- expression of Wfs1 and role in neuronal maturation;
- mechanisms and application of the peptide mediated cellular delivery.

Projects financed by the Estonian Ministry of Education and Research:

- Cellular, developmental and evolutionary factors in the development of organisms and in formation of animal biodiversity (A. Karis),

Projects financed by the Estonian Science Foundation:

- Internalization mechanisms and selectivity of peptidic and nonpeptidic cellular delivery vehicles (M. Pooga)
- Nucleotide exchange factor (GEF) Ric-8: biological role in the mammalian gastrulation, asymmetric division, neurogenesis and behavioral physiology (A. Karis)
- Developmental studies on Wfs1 expression in the brain and its relation to neuronal maturation (K. Lilleväli)
- Role of Gata-3 and related factors in the development of heart (R. Raid)

Personnel of the chair:

Alar Karis, Professor of Developmental Biology, cand. (vet.), MVD
Jüri Kärner, Professor Extraordinarius in General Zoology, DSc (biology)
Raivo Raid, Senior Lecturer of Developmental Biology, cand. (biology)
Martin Kärner, Lecturer of General Zoology, MSc (general zoology)
Kärt Padari, Research Fellow, PhD (developmental biology)
Kaja Reisner, Research Fellow, MSc (cell biology)
Kersti Lilleväli, Research Fellow, PhD (developmental biology)
Pille Säälk, Extraordinary Researcher, PhD (cell biology)
Külliki Saar, Research Fellow, PhD (neurochemistry and neurotoxicology)
Tambet Tõnissoo, Extraordinary Research Fellow, MSc (transgenic technology)
Riho Meier, Extraordinary Research Fellow, MSc (molecular biology)
Mall Kure, Laboratory Assistant



PhD students:

Merly Saare

Sirje Lulla

Kaire Tsaro

Kaida Koppel

Helin Räägel

Annely Lorents

Aira Niinep

The personnel mostly teach developmental biology (main, advanced and laboratory course) and disciplines related to it, like developmental neurobiology, experimental embryology, human anatomy and physiology, histology, microscopy etc.

Selected publications:

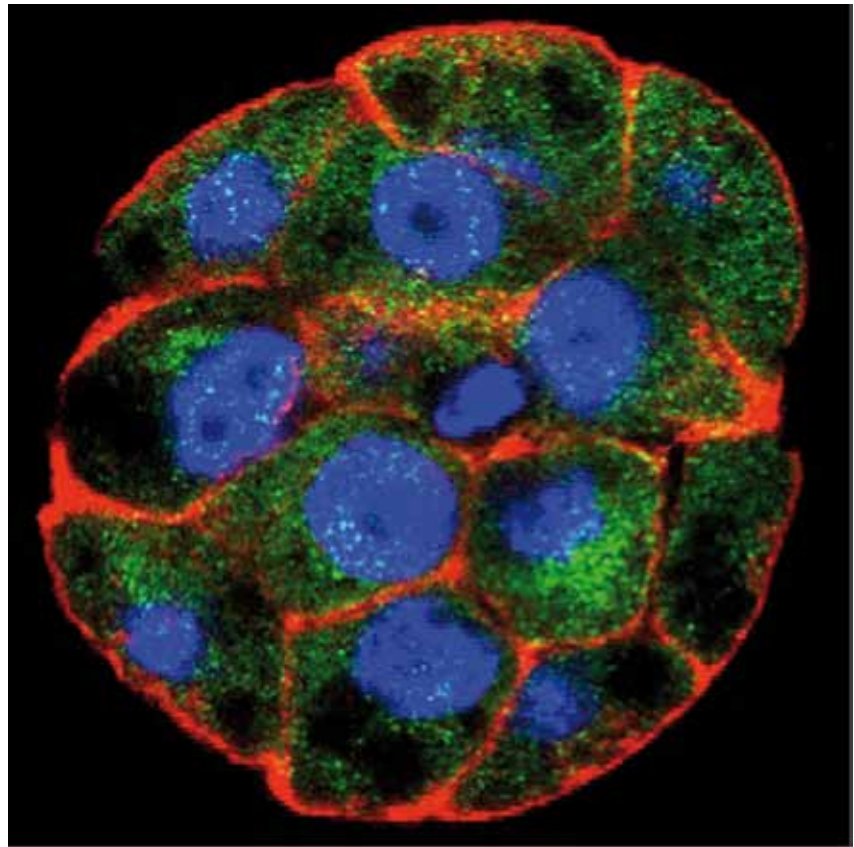
■ Pooga, M., Kut, C., Kihlmark, M., Hällbrink, M., Fernaeus, S., Raid, R., Land T., Hallberg, E., Bartfai, T., and Langel, Ü. (2001) Cellular translocation of proteins by transportan. *FASEB Journal*, 15(6), 1451-1453

■ Säälük, P., Elmquist, A., Hansen, M., Padari, K., Saar, K., Viht, K., Langel, Ü., and Pooga, M. (2004) Protein cargo delivery properties of cell-penetrating peptides, a comparative study. *Bioconjugate Chemistry*, 15, 1246-1253

■ Kala, K.; Haugas, M.; Lilleväli, K.; Guimera, J.; Wurst, W.; Salminen, M.; Partanen, J. (2009). Gata2 is a tissue-specific post-mitotic selector gene for midbrain GABAergic neurons. *Development*, 136, 253-262.

■ Palm, C., Lorents, A., Padari, K., Pooga, M., and Hällbrink, M. (2009) The membrane repair response masks membrane disturbances caused by cell penetrating peptide uptake, *FASEB Journal* 23, 214-223

■ Räägel, H., Säälük, P., Hansen, M., Langel, Ü., and Pooga, M. (2009) CPP-avidin complexes trafficked through the endo-lysosomal pathway form a population of vesicles with non-acidic pH, *Journal of Controlled Release*, 139, 108-117



Localization of Ric-8 (green) in mouse blastocyst. Nuclei in blue and f-actin red.

■ Raid, R.; Krinka, D.; Abdelwahid, E.; Bakhof, L.; Jokinen, E.; Kärner, M.; Malva, M.; Meier, R.; Pelliniemi, L.J.; Ploom, M.; Pooga, M., and Karis, A. (2009). Lack of Gata3 results in conotruncal heart anomalies in mouse. *Mechanisms of Development*, 126, 80-89

■ Padari, K., Koppel, K., Lorents, A., Hällbrink, M., Mano, M., de Lima, M.C. and Pooga, M. (2010) S413-PV cell-penetrating peptide forms nanoparticle-like structures to gain entry into cells, *Bioconjugate Chemistry* 16,

CHAIR OF EVOLUTIONARY BIOLOGY

Senior researcher Ene Metspalu
PhD, Head of the Chair

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<http://evolutsioon.ut.ee>

Since 1996 the research in this chair is focused mainly, though not solely, to the reconstruction of the demographic history of *Homo sapiens* – a subject sometimes called also archaeogenetics. Phylogeny and phylogeography of matrilineal mitochondrial DNA and patrilineal Y chromosome of modern humans, as well as the whole genome variation among populations, are the approaches we employ in order to understand ancient and more recent human migrations and their role in genetic structuring of our species worldwide. In short: we ask who we are, from where we came from, whereas “we” is defined as anatomically modern humans. Being complemented by knowledge obtained from archaeology, history in general and linguistics and considering palaeoenvironmental aspects, it is largely an

interdisciplinary quest, what we follow in intensive collaboration with many colleagues worldwide. The Chair is a partner of the Estonian Centre of Excellence in Genomics.

Lecture courses taught by the Chair are as follows:

LOMR.02.004 Mechanisms of Evolution
LOMR.02.003 Theory of Evolution
LOMR.02.002 Molecular Evolution
LOMR.02.006 Population Genetics
LOMR.02.001 Immunology and Immunogenetics
LOMR.02.005 Methods in Molecular Immunology (practical work)

Selected 7 publications:

- Kivisild, T. et al. (1999). Deep common ancestry of Indian and western-Eurasian mitochondrial DNA lineages. *Current Biology*, 9(22), 1331-1334.
- Kivisild, T. et al. (2002). The Emerging Limbs and Twigs of the East Asian mtDNA Tree. *Mol.Biol.Evol.* 19:1737-1751
- Kivisild, T. et al. (2004). Ethiopian mitochondrial DNA heritage: Track-

ing gene flow across and around the gate of tears. *Am.J.Hum.Gen.*, 75(5), 752-770.

- Hudjashov, G. et al. (2007) Revealing the prehistoric settlement of Australia by Y-chromosome and mtDNA analysis *Proc Natl Acad. Sci. USA.* 104:8726-8730
- Rootsi, S. et al.(2007) A counter-clockwise northern route of the Y-chromosome haplogroup N from Southeast Asia towards Europe. *Eur. J. Hum. Genet.* 15:204-211.
- Behar, DM. et al. (2008). The dawn of human matrilineal diversity: Insights from complete mitochondrial genomes. *Am. J.Hum. Genet.* 82:1-11.
- Rasmussen, M. et al. (2010) Ancient human genome sequence of an extinct Palaeo-Eskimo. *Nature* 463: 757-762

Research group:

The research done is tightly linked to that in the Estonian Biocentre. That is why we added researchers from Estonian Biocentre, working with us side by side, to the list and asked them to participate on the illustrating photo.



CHAIR OF GENERAL AND MICROBIAL BIOCHEMISTRY

Professor Juhan Sedman
Biol.Cand., Head of the Chair

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Fax: +372-7420286

E-mail: juhan.sedman@ut.ee or
jsedman@ebc.ee

Research in the Chair of General and Microbial Biochemistry is focused on two different topics:

■ Mitochondrial DNA metabolism (prof. Juhan Sedman). We are also interested to understand the signal transduction pathways that connect the metabolic status of mitochondria with nuclear gene expression.

■ Enzymatic hydrolysis of cellulose (assoc. prof. Priit Väljamäe)

Our first research focus is DNA metabolism in mitochondria of *S. cerevisiae* and *Candida* species. We would like to understand the complex topology of mitochondrial DNA molecules and the enzymatic mechanisms utilized to support different stages of DNA synthesis. Our special interest is the role of different helicases in mitochondrial genome maintenance.

Our second research interest is to understand kinetic properties of cel-lulohydrolytic enzyme complexes in *Trichoderma reesei*.

Lecture courses:

LOMR.08.005 Biochemistry I

LOMR.08.006 Biochemistry II

LOMR.08.007 Yeast Genetics

LOMR.08.004 Protein Chemistry

LOMR.08.003 Applied Biochemistry

LOMR.08.002 Practical Course in

Biochemistry

LOMR.08.001 Enzymology

Publications:

■ Sedman T, Kuusk S, Kivi S, Sedman J. (2000) A DNA helicase required for maintenance of the functional mitochondrial genome in *Saccharomyces cerevisiae*. *Mol Cell Biol*, 20:1816-24.

■ Lee CM, Sedman J, Neupert W, Stuart RA. (1999) The DNA helicase, Hmi1p, is transported into mitochondria by a C-terminal cleavable targeting signal. *J Biol Chem*. 274; 20937-42.

■ Kuusk S, Sedman T, Jöers P, Sedman J. (2005) Hmi1p from *Saccharomyces cerevisiae* mitochondria is a

structure-specific DNA helicase. *J Biol Chem*. 280(26):24322-9.

■ Visacka K, Gerhold JM, Petrovicova J, Kinsky S, Jöers P, Nosek J, Sedman J, Tomaska L. (2009) Novel subfamily of mitochondrial HMG box-containing proteins: functional analysis of Gcf1p from *Candida albicans*. *Microbiology*. 155:1226-40.

■ Tamm T. (2009) Plasmids with E2 epitope tags: tagging modules for N- and C-terminal PCR-based gene targeting in both budding and fission yeast, and inducible expression vectors for fission yeast. *Yeast*. 26:55-66.

■ Reducing end-specific fluorescence labeled celluloses for cellulase mode of action (2010) Riin Velleste, Hele Teugjas and Priit Väljamäe. *Cellulose*. 17:125-138



BIOL BIOCHEMISTRY

Personnel of the chair:

Juhan Sedman, Professor, Biol.Cand.,
Head of the Chair

Priit Väljamäe, Associate Professor
(PhD)

Hele Teugjas, Lecturer (MSc)

Tiina Tamm, Research Scientist (PhD)

Tiina Sedman, Research Scientist
(PhD)

Priit Jõers, Research Scientist (PhD)
(position temporarily resumed)

Silja Kuusk, Research Scientist (PhD)
(position temporarily resumed)

Anu Aun, PhD Student

Ilja Gaidutšik, PhD Student

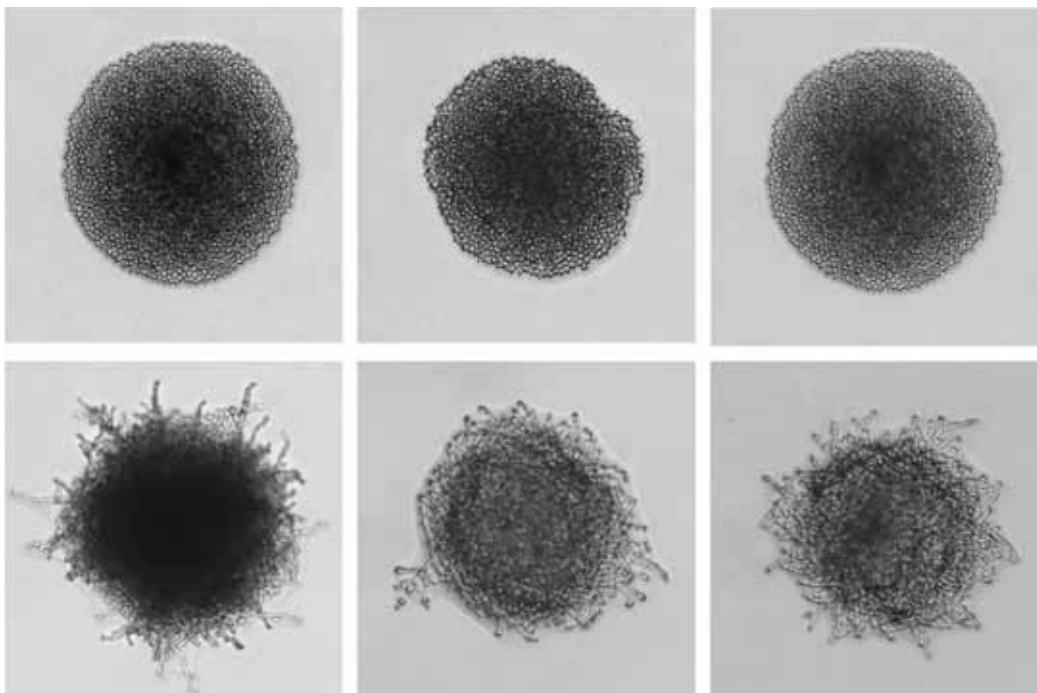
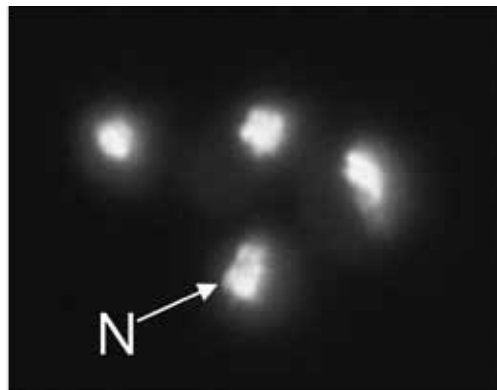
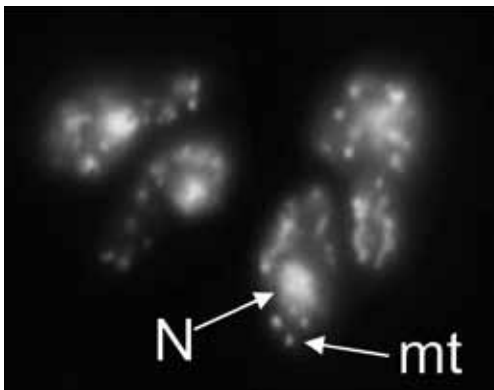
Joachim M. Gerhold, PhD Student

Jürgen Jalak, PhD Student

Katrin Viikov, PhD Student

Katarina Visačka, Visiting Graduate Student
(Comenius University, Slovakia)

Maie Loorits, Senior Laboratory Assistant



Wt and rho mutant strains of yeast *S. cerevisiae* stained with DAPI (A) and different colony morphology on rich medium and under starvation conditions (B).

CHAIR OF GENETICS



Professor Ain Heinaru
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GENOME ORGANISATION AND EVOLUTION OF BIODEGRADATIVE PLASMIDS IN BACTERIA OF THE BALTIC SEA ECOSYSTEM

Professor Ain Heinaru
PhD, Head of the Group

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Research topics:

- Catabolic performance of microbial communities
- Oil-contaminated sea water
- Gene clusters for biodegradation of phenolic compounds
- Horizontal gene transfer
- Plasmid gene structure and evolution
- Comparison of complete nucleotide sequences of biodegradative plasmids

Lecture courses:

- LOMR.03.002 Water and Soil Microbiology
- LOMR.03.008 Molecular Ecology of Microbes
- LOMR.03.018 Environmental Microbiology
- LOMR.03.024 Environmental Biotechnology
- LOMR.03.006 Food Microbiology and Microbiological Control

Practical courses:

- LOMR.03.005 Practical Course of Microbiology
- LOMR.03.021 Practical Course of Microbiology and Virology

Research group:

Ain Heinaru, Head of the Group, Prof. Biol.Cand (PhD)
Jaak Truu, Senior Research Scientist, PhD

Eve Vedler, Research Scientist, PhD
 Signe Viggor, Research Scientist, PhD
 Jaanis Juhanson, Research Scientist,
 MSc (PhD expected in 2010)
 Merike Jõesaar, Research Scientist,
 MSc (PhD expected in 2010)
 Eeva Heinaru, Research Scientist, MSc
 Jekaterina Jutkina, PhD Student
 Hiie Nõlvak, PhD Student
 Mario Mitt, PhD Student
 Ene Põldroos, Technician
 Mihkel Mäesaar, Master Student
 Annika Vilem, Master Student
 Undgraduate students

Important publications:

■ Heinaru, E., Truu, J., Stottmeister, U., Heinaru, A. (2000). Three types of phenol and p-cresol catabolism in phenol- and p-cresol degrading bacteria isolated from river water continuously polluted with phenolic compounds. *FEMS Microbiology Ecology*, 31(3), 195-205.

■ Vedler, E., Vahter, M., Heinaru, A. (2004). The completely sequenced plasmid pEST4011 contains a novel IncP1 backbone and a catabolic transposon harbouring *tfd* genes for 2,4-dichlorophenoxyacetic acid degradation. *Journal of Bacteriology*, 186(21), 7161-7174.

■ Heinaru, E., Merimaa, M., Viggor, S., Lehiste, M., Leito, I., Truu, J., Heinaru, A. (2005). Biodegradation efficiency of functionally important populations selected for bioaugmentation in phenol- and oil-polluted area. *FEMWS Microbiology Ecology*, 51(3), 363-373.

■ Juhanson, J., Truu, J., Heinaru, E., Heinaru, A. (2009). Survival and catabolic performance of introduced *Pseudomonas* strains during phytoremediation and bioaugmentation field experiment. *FEMS Microbiology Ecology*, 70(3), 446-455.

■ Heinaru, E., Vedler, E., Jutkina, J., Aava M., Heinaru, A. (2009). Conjugal transfer and mobilization capacity of the completely sequenced plasmid pNAH20 from multiplasmid strain *Pseudomonas fluorescens* PC20. *FEMS Microbiology Ecology*, 70(3), 563-574.

RESEARCH GROUP OF MICROBIAL GENETICS

Professor Maia Kivisaar
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Main fields of the research (responsible scientist):

- Mutational processes in bacteria (Professor of Microbial Genetics Maia Kivisaar)
- Signal transduction network regulating autolysis of bacteria (Senior researcher Dr. Rita Hõrak)
- Regulation of mobile DNA elements in *Pseudomonads* (Researcher Dr. Heili Ilves)
- Study of the functions of global regulator Fis in *Pseudomonas putida* (Researcher Dr. Riho Teras)

Key words:

Evolution of bacteria under stressful conditions; DNA polymerases and repair systems in *pseudomonads*; DNA recombination; factors regulating DNA repair synthesis; oxidative stress; stationary phase mutagenesis; activation of mobile DNA elements under stressful conditions; protein-DNA interactions at the ends of mobile DNA elements; ColR/ColS two-component signal transduction pathway; second messenger c-di-GMP; membrane stress; autolysis of bacteria; phenol tolerance; Fis regulon; role of Fis on Fe uptake, colonization of plant roots by bacteria and on motility of bacteria.

Lecture courses:

LOMR.03.010 Genetics I
 OMR.03.011 Genetics II
 LOMR.03.015 Molecular Microbiology

Practical courses:

LOMR.03.009 Exercises in Genetics
 LOMR.03.012 Practical Courses in Genetics



Research group:

Maia Kivisaar (Professor, PhD)
 Rita Hõrak (Senior Researcher, PhD)
 Heili Ilves (Researcher, PhD)
 Marta Putrins (Researcher, PhD)
 Signe Saumaa (Researcher, PhD)
 Riho Teras (Researcher, PhD)
 Kairi Tarassova (Researcher, MSc)
 Julia Jakovleva (PhD Student)
 Paula Ann Kivistik (PhD Student, MSc)
 Katren Mikkel (PhD Student)

Master students: Tatjana Jatsenko, Triinu Juurik, Eveli Kallas, Andriõ Lahaasaare, Külliki Püvi; Julia Sidorenko, Olga Šapran, Annika Teppo, Anna Velts

Undergraduate students: Andres Ainelo, Kadi Ainsaar, Tanel Ilmjärv, Laura Kunder, Jana Lillo, Hanna Moor, Karl Mumm, Liina Saar, Siiri Sarv, Hedvig Tamman

Publications:

■ Teras, R., Jakovleva, J., and Kivisaar, M. (2009) Fis negatively affects binding of Tn4652 transposase by out-competing IHF from the left end of Tn4652. *Microbiology* 155:1203-1214.

■ Tarassova, K., Tegova, R., Tover, A., Teras, R., Tark, M., Saumaa, S., and Kivisaar, M. (2009) Elevated mutation frequency in survival population of carbon-starved rpoS-deficient *Pseudomonas putida* is caused by reduced expression of superoxide dismutase and catalase. *Journal of Bacteriology* 191:3604-3614.

■ Kivistik, P.A., Kivi, R., Kivisaar, M., and Hõrak, R. (2009). Identification of ColR binding consensus and prediction of regulon of ColRS two-component system. *BMC Mol. Biol.* 10:46.

■ Tark, M., Tover, A., Koorits, L., Tegova, R., and Kivisaar, M. (2008) Dual role of NER in mutagenesis in *Pseudomonas putida*. *DNA Repair* 7:20-30.

■ Putrinš, M., Ilves, H., Kivisaar, M., and Hõrak, R. (2008) ColRS two-component system prevents lysis of subpopulation of glucose-grown *Pseudomonas putida*. *Environmental Microbiology* 10:2886-2893.

REGULATION OF VIRULENCE FACTORS SYNTHESIS IN PECTOBACTERIUM CAROTOVORUM

Assoc. prof. Andres Mäe
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Pectobacterium carotovorum subsp. *carotovorum* (Pcc) is a pathogen of many plant species, causing soft-rot disease in a wide range of crops world-wide. Elicitation of soft-rot disease requires production of plant cell wall degrading enzymes (PCWDE). The expression of virulence factors and other traits associated with virulence is tightly regulated and responds to various physiological controls including growth-phase induction, catabolite repression, and variation in environmental conditions. Using both genetic and biochemical approaches we have shown that that RcsCDB phosphorelay, FlhDC and RcsB RNA are linked to form a part of the regulatory network that coordinately controls the production of PCWDE in Pcc.

Lecture courses:

LOMR.03.001 Genetics of Microorganisms
 LOMR.03.013 Microbial Physiology
 LOMR.03.014 Transgenic Technology
 LOMR.03.017 Genetically Modified Organisms
 LOMR.03.010 Genetics I (Open University)

Research group:

Andres Mäe, Head of the Group, Associate Professor, PhD
 Liis Andresen, Research Scientist, MSc
 Eve Laasik, Research Scientist, MSc
 Viia Kõiv, Technician

Important publications:

■ Kõiv V., Mäe A. (2001). Quorum sensing controls the synthesis of virulence factors through modulat-



ing rsmA gene expression in *Erwinia carotovora* subsp. *carotovora*. *Mol. Gen. Genet.* 265, 287-292.

■ Andresen, L., Kõiv, V., Alamäe, T. and Mäe A. (2007). The Rcs phosphorelay modulates the expression of plant cell wall degrading enzymes and virulence in *Pectobacterium carotovorum* ssp. *carotovorum*. *FEMS Microbiol Lett.* 273, 229-38.

USING HANSENULA POLYMORPHA FOR BASIC RESEARCH AND BIOTECHNOLOGICAL APPLICATIONS

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We have studied *Hansenula polymorpha* (Hp) a yeast model to study utilization of disaccharides and sugar-related up- and downregulation of cellular pathways. We have shown that glucose repression signaling in Hp is not mediated by a specific hexose kinase as in baker's yeast.

Rather, some metabolite produced in early catabolism of glucose is sensed as a glucose signal. We have studied a genomic locus responsible for maltose and sucrose metabolism, cloned the maltase and permease genes of this locus and characterized respective proteins. The promoter of the maltase gene was shown to function also in bacteria and was used to drive heterologous expression of levansucrases of *Pseudomonas syringae* in *Escherichia coli*. Now, we focus on characterization and structure-function study of these levansucrases.

Lecture courses:

LOMR.03.003 General Microbiology
LOMR.03.004 Microbial Systematics
LOMR.03.016 Microbiology I
LOMR.03.020 Microbiology II
P2TC.00.009 Biology of Microorganisms

Research group:

Tiina Alamäe, Head of the Group, Associate Professor, PhD
Tiina Michelson, Research Scientist
Triinu Visnapuu, PhD Student
Katrinn Viigand, PhD Student
Karin Mardo, MSc Student
Andres Lõhmus, MSc Student
Two undergraduate students.

Important publications:

■ Liiv, L., Pärn, P. and Alamäe, T. (2001). Cloning of maltase gene from a methylotrophic yeast *Hansenula polymorpha*. *Gene*, 265, 77-85.

■ Karp, H., Järviste, A., Kriegel, T. M., Alamäe, T. (2004). Cloning and biochemical characterization of hexokinase from *Hansenula polymorpha*. *Curr. Genet.*, 44, 268-276

■ Triinu Visnapuu¹, Alina D. Zamfir, Cristina Mosoarca, Michaela D. Stanescu, Tiina Alamäe (2009). Fully automated chip-based negative mode nano-electrospray mass spectrometry of fructooligosaccharides produced by heterologously expressed levansucrase from *Pseudomonas syringae* pv. *tomato* DC3000. *Rapid Communications in Mass Spectrometry*. 23, 1-10



CHAIR OF MOLECULAR BIOLOGY

Professor Jaanus Remme
PhD, Head of the Chair

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We are interested in the structure-function of protein synthesis machinery.

Ribosome biogenesis and degradation. Bacterial ribosome consists of over 50 different protein and 3 rRNA molecules. Ribosome assembly involves processing, modification and folding of the rRNA and r-proteins and association of both the proteins and the rRNA into functional ribosomal subunits. The main question of our research is: Functional relation between different steps of ribosome biogenesis and degradation.

Ribosome repair is tightly connected to the ribosome degradation. We ask the question: What happens to the ribosome when one of its 54 proteins is damaged? These are the unanswered questions. We have found evidence that replacement of damaged r-proteins can restore ribosome functioning both in vitro and in vivo.

Functional structure of rRNA has been studied in our chair over 15 years. The main approach has been site-directed mutagenesis of 23 and biochemical characterization of mutant ribosomes.

We collaborate with:

- Institute of Technology, University of Tartu (Prof. T. Tenson, L. Peil)
- University of Southern Denmark (Prof. S. Douthwaite)
- University of Munich (Dr. D. Wilson)
- Tallinn Technical University (Prof. T. Timmusk)

Personnel of the chair:

Jaanus Remme (PhD), Professor, Head of the Chair
Aivar Liiv (PhD) Senior Research Fellow
Ülo Maiväli (PhD) Researcher
Kai Virumäe (MSc) Researcher
Margus Leppik (MSc) Laboratory Assistant

PhD Students:

Rya Ero, Kalle Kipper, Margus Leppik, Arto Pulk, Triinu Siibak, Anton Giuseppe Peier, Kerli Piir
MSc Student: Pavel Kudrin

Undergraduate Students: Triin Tammsalu, Maris Nuhkat

Lecture courses:

LOMR 05.008 Molecular Biology
LOMR 05.006 Protein Biosynthesis
LOMR 05.004 Nucleic Acids (lecture course and practical course)
LOMR 05.001 Plant Molecular Biology (lecturer prof. Erkki Truve from Tallinn Technical University)

Publications:

■ Virumäe, K., Saarma, U., Horowitz, J., Remme, J. (2002) Functional Importance of the 3'-terminal Adenosine of tRNA in Ribosomal Translation. *J. Biol. Chem.* 277, 24128-24134.

■ Maiväli, Ü. Remme, J. (2004) Definition of bases in 23S rRNA essential for ribosomal subunit association. *RNA* 10, 600-604.

■ Liiv, A., Remme, J. (2004) Importance of transient structures during post-transcriptional refolding of the pre-23 S rRNA and ribosomal large subunit assembly. *J. Mol. Biol.* 342, 725-741.

■ Ougland, R., Zhang, C-M., Liiv, A., Johanson, R. F., Seeberg, E., Hou, Y-M., Remme, J. Falnes, P. Ø. (2004) AlkB Restores the Biological Function of mRNA and tRNA Inactivated by Chemical Methylation. *Mol. Cell* 16, 107-116.

■ Ero, R., Peil, L., Liiv, A., Remme, J. (2008) Identification of pseudouridine methyltransferase in *Escherichia coli*. *RNA* 14, 2223-2233.

■ Pulk, A., Liiv, A., Peil, A., Maiväli, Ü., Nierhaus, K.H., and Remme J. (2010) Ribosome reactivation by replacement of damaged proteins. *Mol. Microbiol.*



ADMINISTRATION

THE ADMINISTRATION AND NON-ACADEMIC PERSONNEL OF THE INSTITUTE

SITTING, FROM LEFT TO RIGHT:

- Sulev Ingerpuu, Scientific Secretary
- Mart Roos, Engineer
- Tiiu Rootslane, Assistant of the Director
- Milvi Siniroht, Technician
- Annely Kukk, Senior Laboratory Assistant

STANDING, FROM LEFT TO RIGHT:

- Sulev Kuuse, Head of the Vivarium
- Katrin Kepp, Project Manager of the Graduate School in Biomedicine and Biotechnology
- Ingrid Jalak, Accountant
- Sirje Kask, Laboratory Assistant
- Aivar Torp, Specialist
- Lagle Lõhmus, Academic Affairs Specialist
- Teele Eensaar, Project Manager
- Alar Tuubel, Transport and Customs Specialist
- Toivo Maimets, Director of the Institute
- Joachim Matthias Gerhold, Specialist
- Sirje Habak, Laboratory Assistant
- Toomas Koppel, IT Specialist
- Dmitri Lubenets, Engineer



