NB! Print view does not include files that are attached to the form. Files should be printed out separately.

EV98 application 2017

General information

Institution	National Institute of Chemical Physics and Biophysics
(Corresponding) R&D field	3. Medical and health sciences
Evaluation period	2010 - 2015
The person responsible	Kristian Sülluste
Structural unit(s) to be evaluated	

National Institute of Chemical Physics and Biophysics

Short summary of the institution (formation, activities and role in the Estonian R&D)

The National Institute of Chemical Physics and Biophysics (NICPB) was founded on 16th ofFebruary 1980 as the Institute of Chemical Physics and Biophysics of the Estonian Academy of Sciences. The Institute was formed on the basis of (i) the Department of Physics and (ii) the Department of Biochemistry of the Institute of Cybernetics and (iii) a research group of molecular genetics of the Institute of Physics. Since 1998 the NICPB is a public research institution – a National Laboratory, financed from the state budget and research grants. Today NICPB consists of four laboratories. The Laboratory of Chemical Physics is still the largest laboratory in the institute. In 2011 the Labortory of High-Energy and Computational Physics was formed from it to host all CERN related theoretical and experimental activities at NICPB. In 2012 the laboratory of Molecular Genetics was renamed to the Laboratory of Environmental Toxicology to reflect the changed focus of research. The Laboratory of Bioenergetics was established in 1993. The Laboratory of Bioorganic Chemistry was closed in 2016 as its scientists were not successful in obtaining research grants.

The strength of NICPB is its excellence in research: the scientists of NICPB have published 59 highly cited papers in 2004 – 2014, which is 21% of similar level papers from all Estonian research institutions and universities combined, see "Progress in Estonian science viewed through bibliometric indicators (2004–2014)" Proceedings of the Estonian Academy of Sciences, 2015, Vol. 64, No. 2, 125–126. This is a very large share for a small institute, but of course one would expect that a national institute would stand out.

Among Baltic countries NICPB is the only institution who runs a helium liquefier or hosts a Tier-2 centre for the CERN computing grid (WLCG). That datacentre is not only used for LHC related computing, but is actually serving a multitude of fields including material science, astroparticle physics, medicine, etc. and is part of the Estonian Research Computational Infrastructure (ETAIS).

The share of medical and health sciences in the research programs of NICPB is small.It is important as it allows studying the mechanisms of cellular pathologies using the methods of biophysics and biochemistry, giving an input to researcher's working in the field clinical medicine.

Short summary of the institution's R&D management (incl. support services)

According to the "National Institute of Chemical Physics and Biophysics Act" the management bodies of the NICPB are the director and the science council, see the organization chart of NICPB. NICPB is managed by the director who is elected by the science council. The international Science Advisory Board (SAB) periodically evaluates the research programmes of NICPB and advises the science council to open new programmes and/or to terminate existing programmes. SAB also evaluates scientific and administrative capacities of the candidates to the posts of the director and the heads of laboratories.

The science council is the collegiate decision making body of NICPB which consists of 19 members including the director, deputy directors, scientific secretary and leading scientists of NICPB and related fields. According to the NICPB act the science council 1) approves the main directions of the activities of NICPB, and carries out supervision over their implementation; 2) Approves the Statutes of NICPB and makes amendments to them; 3) Elects members of the research staff of the NICPB ; 4) Approves the financial plan; etc.

The structure of NICPB includes scientific, administrative and economic units. In 2017 the scientific subdivisions consist of laboratories of Chemical Physics, Molecular Genetics, Bioenergetics and High-energy and Computational Physics. The laboratory of Bioorganic Chemistry was closed in 2016. The laboratories carry responsibility for the Institute's scientific infrastructure. Specific scientific research is divided into programs, contracts and grants. The PI of the particular program or project is both authorizing the resources as well as carrying the responsibility for the results of the research. Scientific infrastructure is available for universal usage of all programs, contracts and grants..

Short summary of the process of drawing up the self-evaluation report

In preparation to the current evaluation the international Science Advisory Board (SAB) of NICPB visited the institute in September 2016 and performed a review of the management, strategy and research programs. According to the assessment of SAB, signed by Prof. Peter Littlewood, director of Argonne National Laboratory, the "Institute is sound and well run, with a good relationship between the Staff and the Director. The NICPB is evolving a strategy and direction that will be beneficial for the Institute and for Estonia as a whole, and despite some structural and financial impediments, is performing well scientifically."

While preparing the current self-evaluation, heads of laboratories and group leaders focused on specific

topics: staff, resources, R&D activities, training of PhD students and scientific results. The section of general information was written by the director of the institute, based on discussions with colleagues. The selection of 30 most important projects was straightforward: institutional research projects, centres of excellence, large infrastructure and collaboration projects etc. The list of 30 most significant papers covers all our fields of research.

We held 3 weekly meetings with heads of the laboratories to coordinate our activities.

Institution`s request to the experts for further information about the following aspects of the corresponding R&D field

The greatest threat to the sustainable excellent research in NICPB is the virtually 100% grant based funding. We would appreciate comments of the evaluators regarding similar funding schemes of national research institutes.

Additional information

NICPB_SAB_ 2016 final.pdf

Comment_on_NICPB_SAB_2016_final.pdf

Staff

Staff engaged in R&D in the corresponding field	2010	2011	2012	2013	2014	2015
Number of persons	**45**	**44**	**46**	**48**	**50**	**44**
1. research staff	28	29	30	30	34	34
2. teaching staff	0	0	0	0	0	0
3. technical and auxiliary staff	17	15	16	18	16	10
Full-time equivalent	**39,40**	**37,25**	**40,75**	**41,75**	**44,50**	**39,70**
1. research staff	25,80	26,35	29,15	28,65	32,60	32,15
2. teaching staff	0,00	0,00	0,00	0,00	0,00	0,00
3. technical and auxiliary staff	13,60	10,90	11,60	13,10	11,90	7,55
percentage of staff with research degree	100	100	96	96	91	84

Staff engaged in R&D in the corresponding field	2010	2011	2012	2013	2014	2015
percentage of women among scientists	60	64	62	63	61	65
percentage of foreign scientists	0	0	0	0	0	0

Comments

The research staff involved into the field of Medicine has increased from 28 to 34. More than half of the employees in this field are younger than 35 years. The number of technical and auxiliary staff includes also students who work in the institute. The drop of personnel in 2015 is related to unsuccessful grant applications by researchers of the Laboratory of Bioorganic Chemistry that was closed in 2016.

A steady increase of students above the number of those that graduate every year has reduced the % from its peak in 2011. This is a healthy outcome as it shows our ability to attract early phase students from BSc, MSc and PhD programs and increase the sustainability of the research programs.

Staff in the corresponding field (59)

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Ene Valdmann	f		2010, 2011, 2012, 2013, 2014, 2015	1.01.1997-... National Institute of Chemical Physics and Biophysics, Other staff (1,00)	
Valdur Saks	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014,	1.01.2015-31.12.2016 National Institute of Chemical Physics and Biophysics, Senior Research Fellow (0,10); 1.09.2007-31.12.2014 National Institute of Chemical Physics and Biophysics, leading researcher (0,50)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
			2015		
Ene Siigur	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.1984-31.12.2015 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Mari Samel	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2012-31.12.2015 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2006-31.12.2012 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Vladimir Tšekulajev	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2010-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Peeter Sikk	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	13.09.2010-31.12.2011 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,50); 1.01.1980-12.09.2010 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00); 1.01.2012-22.10.2016 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,40)	CV
Katrin Trummal	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.1996-31.12.2010 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2010-31.12.2015 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Lee Põllumaa	f	Doctor's Degree	2010	1.03.2008-31.08.2010 National Institute of Chemical Physics and Biophysics, Extraordinary Senior Researcher (0,25)	CV
Natalja Timohhina	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.07.2007-1.09.2010 National Institute of Chemical Physics and Biophysics, Extraordinary Researcher (1,00); 1.09.2010-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Andre Koit	m	Master's Degree	2012, 2013, 2014, 2015	1.09.2012-31.03.2016 National Institute of Chemical Physics and Biophysics, PhD student (1,00)	CV
Kati Mädo	f	Master's Degree	2013, 2014, 2015	1.01.2014-30.04.2015 National Institute of Chemical Physics and Biophysics, Junior Researcher (0,70); 1.04.2013-31.12.2013 National Institute of Chemical Physics and Biophysics, Other staff (0,50)	CV
Hanna Tähti	f	Doctor's Degree			CV
Kersti Tepp	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.09.2007-9.10.2011 National Institute of Chemical Physics and Biophysics, senior engineer (1,00); 10.10.2011-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Toomas Välimäe	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2012-31.12.2016 National Institute of Chemical Physics and Biophysics, deputy director (1,00); 1.01.2010-31.12.2011 National Institute of Chemical Physics and Biophysics, deputy director (1,00)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Sandra Käosaar	f	Master's Degree	2012, 2013, 2014, 2015	1.09.2012-31.12.2014 National Institute of Chemical Physics and Biophysics, Other staff (1,00); 1.01.2015-31.08.2016 National Institute of Chemical Physics and Biophysics, junior researcher (1,00)	CV
Maire Peitel	f		2010, 2011, 2012, 2013, 2014, 2015	1.01.2008-31.12.2010 National Institute of Chemical Physics and Biophysics, Other staff (0,50); 1.01.2010-30.09.2015 National Institute of Chemical Physics and Biophysics, technician (1,00)	CV
Aleksandr Klepinin	m	Master's Degree	2011, 2012, 2013, 2014, 2015	1.01.2011-31.12.2012 National Institute of Chemical Physics and Biophysics, Other staff (0,75); 1.01.2013-31.08.2014 National Institute of Chemical Physics and Biophysics, insener (0,75); 1.09.2014-31.03.2016 National Institute of Chemical Physics and Biophysics, Junior Researcher (0,75)	CV
Ain Toim	m		2010, 2011, 2012, 2013, 2014, 2015	1.01.2002-... National Institute of Chemical Physics and Biophysics, senior engineer (1,00)	
Juhan Subbi	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.1987-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
			2010, 2011,		

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Imbi Kurvet	f	Master's Degree	2012, 2013, 2014, 2015	1.01.2001-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Aleksandr Käkinen	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2014-31.12.2015 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2011-31.12.2014 National Institute of Chemical Physics and Biophysics, Other staff (0,25); 1.01.2010-31.12.2011 National Institute of Chemical Physics and Biophysics, Other staff (0,50)	CV
Jekaterina Jefimova	f	Doctor's Degree	2010, 2011, 2012, 2013	1.09.2011-31.12.2013 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.09.2007-31.08.2010 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.09.2010-31.08.2011 National Institute of Chemical Physics and Biophysics, senior engineer, a chemist (1,00)	CV
Olesja Bondarenko	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2014-... National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2006-31.12.2013 National Institute of Chemical Physics and Biophysics, Engineer (0,50)	CV
Irina Blinova	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2005-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Heiki Vija	m	Master's Degree	2010, 2011, 2012, 2013, 2014,	1.01.1996-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
			2015		
Urmas Suursalu	m	Master's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2005-... National Institute of Chemical Physics and Biophysics, Other staff (1,00)	CV
Mariliis Sihtmäe	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	23.07.2007-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Liis Seinberg	f	Doctor's Degree	2013, 2014, 2015	1.01.2015-... National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2013-31.12.2015 National Institute of Chemical Physics and Biophysics, Postdoctoral researcher (1,00)	CV
Villem Aruoja	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2007-31.08.2010 National Institute of Chemical Physics and Biophysics, Extraordinary Researcher (0,40); 1.09.2010-1.09.2012 National Institute of Chemical Physics and Biophysics, Researcher (0,40); 1.09.2012-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Anne Kahru	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2007-... National Institute of Chemical Physics and Biophysics, Research Professor (1,00); 1.01.2005-31.12.2011 National Institute of Chemical Physics and Biophysics, Acting Head of Laboratory of Molecular Genetics; 1.01.2012-... National Institute of Chemical Physics and Biophysics, Head of the Laboratory of Environmetal Toxicology; 1.01.2011-31.12.2012 National Institute of Chemical Physics and Biophysics, Head of the Laboratory of Molecular Genetics	CV
			2010, 2011,		

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Liina Kanarbik	f	Master's Degree	2012, 2013, 2014, 2015	1.01.2010-... National Institute of Chemical Physics and Biophysics, engineer (0,80)	CV
Külli Tõnismägi	f	Master's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.1996-28.02.2015 National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Margit Heinlaan	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2011-... National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.03.2004-31.12.2010 National Institute of Chemical Physics and Biophysics, engineer (0,55)	CV
Jasper Adamson	m	Doctor's Degree	2010, 2014, 2015	1.12.2014-... National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.10.2009-1.07.2010 National Institute of Chemical Physics and Biophysics, Extraordinary Researcher (0,20)	CV
Tõnu Kesvatera	m	Doctor's Degree	2010, 2011, 2012, 2013	1.01.1984-30.11.2013 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Angela Ivask	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2007-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Aia Simm	f	Master's Degree	2010	1.01.2007-31.12.2010 National Institute of Chemical Physics and Biophysics, Engineer (0,75)	CV
Tiia Grellier	f	Doctor's Degree	2010, 2011, 2012, 2013	1.01.2007-31.08.2010 National Institute of Chemical Physics and Biophysics, Extraordinary Senior Researcher (1,00); 1.05.2011-31.03.2013 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,50); 1.04.2013-21.08.2013 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,75); 1.09.2010-12.09.2010 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Katre Juganson	f	Master's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2010-30.03.2012 National Institute of Chemical Physics and Biophysics, Technician (0,50); 1.04.2012-31.12.2013 National Institute of Chemical Physics and Biophysics, Engineer (0,70); 1.01.2015-... National Institute of Chemical Physics and Biophysics, Junior Researcher (0,40); 1.01.2014-31.12.2014 National Institute of Chemical Physics and Biophysics, Engineer (1,00)	CV
Monika Mortimer	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2007-31.12.2011 National Institute of Chemical Physics and Biophysics, Researcher (0,50); 1.01.2011-31.12.2012 National Institute of Chemical Physics and Biophysics, Researcher (1,00); 1.01.2013-30.06.2016 National Institute of Chemical Physics and Biophysics, Research Scientist in the Laboratory of Environmental Toxicology (1,00)	CV
Tiina Titma	f	Master's Degree	2013, 2014	1.01.2013-31.12.2014 National Institute of Chemical Physics and Biophysics, engineer (1,00)	CV
Marju Puurand	f	Doctor's Degree	2015	1.09.2015-... National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Jüri Siigur	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2014-28.02.2015 National Institute of Chemical Physics and Biophysics, Research Professor (0,50); 1.09.2007-31.12.2013 National Institute of Chemical Physics and Biophysics, Research Professor (1,00); 1.01.1991-31.08.2016 National Institute of Chemical Physics and Biophysics, Head of laboratory of bioorganic chemistry (0,25); 1.01.1980-31.08.2016 National Institute of Chemical Physics and Biophysics, Scientific secretary (0,25)	CV
			2010,		

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Igor Ševtšuk	m	Doctor's Degree	2011, 2012, 2013, 2014, 2015	1.01.2010-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Tuuli Käämbre	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2014-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00); 1.09.2007-31.12.2014 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,75)	CV
Kristian Sülluste	m		2010, 2011, 2012, 2013, 2014, 2015	1.01.2006-... National Institute of Chemical Physics and Biophysics, Other staff (1,00)	CV
Els Heinsalu	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2015-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00); 1.01.2007-31.12.2014 National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Anu Aaspõllu	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2008-28.02.2011 National Institute of Chemical Physics and Biophysics, Senior Researcher (0,25); 1.03.2011-28.02.2015 National Institute of Chemical Physics and Biophysics, Other staff (0,10)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Margit Lassi	f	Master's Degree	2010, 2011, 2012	1.01.2008-31.08.2011 National Institute of Chemical Physics and Biophysics, Extraordinary Researcher (0,90); 1.09.2011-31.03.2012 National Institute of Chemical Physics and Biophysics, Researcher (0,20)	CV
Minna Varikmaa	f	Doctor's Degree	2010, 2011, 2013, 2014	1.01.2008-31.12.2011 National Institute of Chemical Physics and Biophysics, Other staff (1,00); 12.12.2013-28.03.2014 National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Toomas Tiivel	m	Doctor's Degree	2010	1.01.2007-31.12.2010 National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Anu Nutt	f	Doctor's Degree	2010	1.01.2007-31.12.2010 National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Indrek Reile	m	Doctor's Degree	2012, 2013, 2014	1.09.2012-31.12.2014 National Institute of Chemical Physics and Biophysics, Researcher (1,00)	CV
Kai Künnis-Beres	f		2012, 2013, 2014	1.01.2012-31.12.2014 National Institute of Chemical Physics and Biophysics, Laboratory of Environmental Toxicology, reserch scientist (1,00)	CV
Ljudmila Õunpuu	f	Master's Degree	2014, 2015	1.01.2014-29.02.2016 National Institute of Chemical Physics and Biophysics, Junior Researcher (1,00)	CV
Marco Patriarca	m	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2008-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV
Meeri Visnapuu	f	Master's Degree	2015	1.01.2015-... National Institute of Chemical Physics and Biophysics, engineer (0,90)	CV

Name	Gender	Degree	Years	Position	CV
filter...	filter...	filter...	filter...	filter...	
Marge Muna	f	Master's Degree	2014, 2015	1.09.2014-31.12.2015 National Institute of Chemical Physics and Biophysics, Engineer (0,25); 1.01.2015-31.12.2016 National Institute of Chemical Physics and Biophysics, Junior Researcher (0,60)	CV
Kaja Kasemets	f	Doctor's Degree	2010, 2011, 2012, 2013, 2014, 2015	1.01.2006-... National Institute of Chemical Physics and Biophysics, Senior Researcher (1,00)	CV

Total revenue in the corresponding R&D field

Source of funding	2010		2011		2012		2013		2014		2015	
	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum
Projects of targeted financing and institutional research funding	**1,0**	109 244	**1,0**	105 200	**1,0**	105 200	**1,0**	105 200	**0,4**	67 560	**0,4**	67 560
Projects of Estonian Science Foundation grants and personal research funding	**1,33**	25 532	**1,33**	25 533	**1,5**	30 788	**0,5**	8 700	**0,5**	8 700	**0,8**	28 846
Domestic R&D contracts (including grant agreements)	**1,00**	479	**1,00**	200	**2,00**	41 849	**3,00**	64 028	**2,00**	35 220	**3,00**	99 183
International contracts and grants	**1,00**	1 510	**3,00**	26 943	**2,00**	61 473	**4,00**	55 534	**3,00**	59 008	**2,00**	7 866
Funding from EU structural funds	**1,00**	31 767	**3,00**	81 955	**3,00**	81 349	**3,00**	81 349	**4,00**	85 093	**3,00**	62 546
Total	**5,33**	**168 532**	**9,33**	**239 831**	**9,50**	**320 659**	**11,50**	**314 811**	**9,90**	**255 581**	**9,20**	**266 001**
R&D revenue per research and teaching staff member	**0,12**	3 663	**0,21**	5 450	**0,21**	6 970	**0,24**	6 698	**0,20**	5 111	**0,18**	5 320
R&D revenue per FTE	**0,13**	4 187	**0,25**	6 344	**0,22**	7 527	**0,28**	7 567	**0,22**	5 623	**0,20**	5 820

Source of funding	2010		2011		2012		2013		2014		2015	
	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum

R&D infrastructure in the corresponding field

Summary of R&D infrastructure

As mentioned above, the NICPB has 4 laboratories (Bioenergetics - head of the laboratory dr. Tuuli Käämbre, Environmental Toxicology- head of the laboratory dr. Anne Kahru, Chemical Physics – head dr. Dan Hüvonen and High Energy Physics and Computational Physics – head dr. Martti Raidal. The research into difference aspects of medicine is performed in all these Laboratories of NICPB. For the period 2010-2015 the working environment in the laboratory of Bioenergetics was improved over the funding application of the scientific apparatus, instruments, and equipment acquisition and modernization (the small-scale and the institutional research equipment modernization grants). The most of laboratory rooms are renovated, the high resolution respirometer Oxygraph-2K (Oroboros instruments) was purchased as well as a Varian Cary 100 BIO&ACD spectrophotometer, and equipment for work with cultured cells (a MCO-19AIC(UV) CO2 incubator, ESCO LHC-4A1 laminar flow clean bench, EcoVac vacuum system, and etc.). Setting up the cell culture laboratory in our own rooms was very important as it made possible to conduct experiments in verified conditions, and this, in turn, allowed extending our research topic from cardiac cell to cancer cell research. A multichannel confocal fluorescence microscope was purchased, as it was one the principal devices that we were heretofore lacking. As a part of the NICPB it possible to use four research grade Bruker NMR spectrometers (the newest Avance III 800MHz).

The laboratories of the Environmental Toxicology were renovated about 10 years ago and some renovation is in progress (3 rooms in the basement). The Lab has necessary routine equipment and facilities for micro- and molecular biology, in vitro cell cultures and ecotoxicology in temperature-conditioned laboratories. The Lab has equipment with Malvern Zetasizer Nano ZS for hydrodynamic particle size and Z-potential analysis, ventilation hood for nanoparticles weighting, PCR thermocyclers, spectrophotometers, inverted and upright optical and fluorescence microscopes, flow cytometer (BD Accuri C6) and TXRF spectrometer for metal analysis (Bruker S2 Picofox). In addition, we have HPLC Agilent 1280 series with PDA and RI detectors and Waters Acquity UPLC with PDA and ELS detectors and wide choice of columns.

Collections	**Collections** Loodusteaduslikud kogud rakubioloogilistes ja toksikoloogilistes uuringutes, National Institute of Chemical Physics and Biophysics.
Objects of core R&D infrastructure	The Estonian Research Computational Infrastructure (or ETAIS) is a network of computing centers and expertise distributed between three major partners. The ideology of this core infrastructure is to provide a large scale compute and storage resource as well as experts on hand to the scientific community. The infrastructure is split betwene Tartu University, Tallinn Technical University and KBFI. Our contribution is a large scale compute cluster that comprises of over 6000 compute cores and ca 2.5PB of disk space. The datacenter is also used as the Estonian Tier-2 center for CERN computing grid (WLCG) providing millions of compute hours of resources to the data analysis efforts at the LHC. However the center is not only used for LHC related computing, but is actually serving a multitude of fields including material science, astroparticle physics, medicine and others. Starting with this year the collaboration of ETAIS is extended from pure compute and store resource provision through schedulers to also provide a dynamic platform of cloud computing allowing research groups to provision resources as they see fit on software architectures that they require. This added flexibility will allow even better resource utilization as well as make sure that all researchers have access to the exact platform that matches their needs. This extension also introduces more flexible and longer term storage prospects allowing for data archiving that has not been possible until now. All the bioassay organisms deposited in NICPB are registered as a database of NICPB scientific collections on the NICPB web-site. Two more databases were created by and hosted on the website of NICPB: database E-SovTox that contains toxicological information Russian language data sources published during the Soviet Union and database NanoE-Tox that contains in-depth nanoecotoxicological information on eight nanomaterials published up to year 2015.
Comments section (comments about collections and/or objects of core infrastructure)	The scientific collections of the NICPB were established in 1980 when the biological research was started. During 2004-2008 the development of the collections was supported by the “National Programme on Scientific collections” in a project “Scientific collections in cell biology and toxicological research” (HLK04-4, PI Dr. A. Kahru). The NICPB collections consist of microbial cultures (bacterial and yeast strains and collection of plasmids), cell lines, venoms and environmental samples (soils, sediments, oil-shale industry solid wastes). Currently, all the bioassay organisms deposited in NICPB are registered as a database of NICPB scientific collections on the NICPB web-site. Two more databases are created by and hosted on the website of NICPB: database E-SovTox that contains toxicological information available in Russian language data sources published during the Soviet Union era and database NanoE-Tox that contains in-depth nanoecotoxicological information on eight nanomaterials published up to year 2015. The scientific

collections of NICPB are continuously upgraded, but unfortunately the targeted governmental support for these activities is lacking. Thus, all the costs of this collection(s) (such as controlling and shipping the bacterial strains and plasmids to interested scientific parties) are paid mostly by the Laboratory of Environmental Toxicology.

Sufficiency of resources from the sustainability and potential point of view

Financial resources: In addition to research grants the institute is funded primarily from two major sources. Baseline financing (about 0.5M€ in 2017), which is based on prior five-year scientific excellence and industry contracts as well as institutional research funding (1.8M€ in 2017) that is grant based, but has rules on possible variances between funding rounds allowing no more than 20% drop on research topics that meet at least average evaluation criteria. This sustained funding has allowed several research programs to reach scientific excellence in the time frame of ten years that is longer than a research grant. However, as of February 2017 this system is changing and the institutional grants will be converted to ordinary research grants for teams without any institutional oversight or guarantees. Such change makes future funding extremely volatile and hampers our possibilities to make long term plans as there is no state provided guaranteed dampening of volatility. While this change comes paired with increase in base financing it is not nearly enough to provide financial stability and long term outlook on its own while competing every few years on all research programs.

Resource funding in Estonia has been project based, the objects that are on the scientific roadmap are financed on a sustained basis, however the funding depends on EU structure funds and there are no clear plans on sustained operation and upkeep financing from the core Estonian budget. So far we have managed the funds and financing rounds well and have been able to grow the scientific equipment and resources at a steady pace, but currently there does not exist financial instruments for sustained upkeep.

Human resources: The Lab of Environmental Toxicology is among the best worldwide in the nanoecotoxicology domain. The group is young and dynamic and consists of 9 senior scientists (PhDs) and 8 PhD students. Two PhDs are currently as post-docs in high-level foreign laboratories. They may also add new ideas and techniques to for the use of the group, when returning back. Object NAMUR+, and it has a research contract grant from the Ministry of Environment to review the current limit values of air pollutants. In Lab of Environmental Toxicology in the time-frame of 2010-2015 altogether 6 PhD and in Lab of Bioenergetics 3PhD degrees were defended. Today 9 PhD students in Lab of Environmental Toxicology and 6 phD students in the lab of Bio energetics are supervised. All the students are working in the laboratory with the working contract or institutional scholarship. More than 50% of the personnel are younger than 35 years. PhD students benefit from the support via Doctoral Schools (scientific missions, participating in conferences), Foundation Archimedes (‘Kristjan Jaak’), but also via COST actions that have special resources for short term scientific missions og young scientists.

R&D activities

Summary of R&D in the corresponding field

Two interdisciplinary research programs in NICPB are involved into the field of Medicine: - molecular system bioenergetics (Laboratory of Bioenergetics) and nanoecotoxicology (Laboratory of Environmental Toxicology). This field is small, but gives the possibility for creating the conditions for development applied biomedical science just due to the interdisciplinarity of the NICPB. Laboratory of Bioenergetics focus on changes in the Intracellular Energetic Units and Mitochondrial Interactosome in health and disease. Cancer cell bioenergetics forms the basis for developing the fundamental and applied bioenergetics aspects of cancer bioenergetics at NICPB as well as in Estonia. The Laboratory of Bioenergetics is collaborating with other workgroups of NICPB, all hospitals in Tallinn, Tartu University and partners from abroad. Recent developments have led to the understanding of the importance of the studies of cellular mechanisms of cancer metabolism in vivo. We plan to continue these studies in direct determination the in vivo energy fluxes in cancer cells via different phosphotransfer pathways by using 18O, 31P and 1H NMR spectroscopy in cancer clinical material (Dr. I. Reile, Dr J. Adamson), quantitative analysis of the energy metabolism by applying the methods of Molecular System Bioenegetics. This combined diagnostic approach will have impact on cancer diagnostics, prognosis and planning of personalized therapy. Laboratory started again work in the field of mathematical modeling of energy transfer systems (Dr. E. Heinsalu; Dr. M. Patriarca).

Nanoexotoxicology is another important field for medicine and it was introduced in Estonia by NICPB (team of A. Kahru) at 2006. By now, they are constantly advancing this competence that is unique for Estonia and competitive in the international scale. The strategic goal of the (eco)toxicology research is to elucidate the hazard of (industrial) chemicals, including novel man-made nanomaterial's. This goal will be approached by answering the following questions: is it toxic, to whom and how toxic, why toxic and how to assess the toxicity comprehensively and cost-effectively. We have been focusing mostly on metal-based nanomaterial's but also other types of oxides.

Bioassay-wise the attention is focused mostly on in vitro tests that allow the assessment of adverse effects and toxicity mechanisms of chemicals and nanoparticles using fast, high-throughput systems. We also design and use new bioassays that are based on mechanism-based modification of bacteria, to make them to respond to bioavailable metals and knock-out yeast strains that are vulnerable to various stress factors. In cooperation with Estonian Universities and international collaborators we have started the analysis of the chemical libraries of novel chemicals using microbial test organisms, to obtain novel scientific knowledge for the synthesis of new efficient antimicrobials and antifungals.

Main research directions in the corresponding R&D field during 2010-2015

Both laboratories involved into Strategic Research Programs of NICPB and part of the studies are tightly involved with the field of Medicine, especially biomedicine.

Previous research in the frames of years 2010-2015 the Lab of Bioenergetics survey recent findings- Intracellular Energetic Unit and Mitochondrial Interactosome in health and disease using the methods of Molecular System Biology. Laboratory studied alterations in the intracellular structural interactions of the oxidative muscle cells and the formation of a mature energy metabolism during postnatal development and impairment it's during ageing. Cardiac and muscle cells are ideal model to study highly organized intracellular systems, where the regulation of cellular bioenergetics is strongly related to their structure. This study gives the theoretical background to understanding the bioenergetics of healthy muscle cells, as well as cellular pathologies like ischemia, heart failure, myocardial infarction, neurodegenerative diseases, mechanisms of ageing and cancer. Changes in cell bioenergetics are one of the first signs of cell pathology; therefore in 2012 the laboratory started the studies of the bioenergetics of the malignant cells. The methodology of MSB and its research methods, such as metabolic control analysis, proteomics and metabolomics techniques, will be used to identify and quantify the cellular regulation and to map tumour specific bioenergetic alterations. Laboratory of Bioenergetics published during these period 41 articles international peer-reviewed journals.

Research carried out in Lab of environmental toxicology is one of the leading directions, as well as one of the scientifically and societally most visible activities in the NICPB. Especially the evaluation of toxicity of nanoparticles has created high-level research with many international contacts. The team of Dr. Kahru has developed novel in vitro methods for the evaluation of the toxicity of chemicals/nanomaterials and also studied the mechanisms of the toxic actions of chemicals/nanomaterials. Especially the role of reactive oxygen species and genotoxic effects has been studied in different environmentally relevant organisms: algae, bacteria, protozoa and crustaceans. Based on the research on toxic mechanisms the most sensitive targets of the toxic action have been elucidated. Determination of the physicochemical properties of NPs (Zn, Cd, Ag, Cu, etc.) is part of the studies, as well as evaluation of the biological availability of the particles. The current guidelines (EU, OECD) do not provide specific test methods for nanoparticles. Many test methods developed in the Lab of Environmental Toxicology are very promising in vitro tests in ecotoxicology, and could be submitted into the validation process of EURL- ECVAM (European Reference Lab in the European Centre for Validation of Alternative Methods), which is needed before the acceptance to the regulatory use.

The most important projects in the main research areas of the corresponding field during 2010-2015 (22)

Number	Project title in Estonian	Principal investigator	Finance program	Start Year	End Year	Total
SF0180114Bs08	Mechanisms of regulation of integrated energy metabolism in muscle cells	Valdur Saks	SF	2008	2013	657 119,57 EUR
ETF7823	Dynamics of formation of modular bioenergetic systems during differentiation of stem cells into myocytes and their degradation during ageing	Valdur Saks	ETF	2009	2012	88 352,54 EUR
ETF7117	Compartmentalized systems of energy metabolism and their disorders in cardiac, gastric epithelial and brain cells	Enn Seppet	ETF	2007	2010	75 160,08 EUR
IUT23-1	Mechanisms of regulation of integrated energy metabolism in tumor and muscle cells.	Tuuli Käämbre	IUT	2014	2019	675 600,00 EUR
TAP19-2	KBFI bioloogiapoole teadusaparatuuri kaasajastamine: biofüüsika	Tuuli Käämbre	TAP	2011	2015	156 142,55 EUR
KBFI,BE-2	KOOSTÖÖLEPING METABOOLSETE TESTIDE TEOSTAMISEKS NING TESTIMETOODIKA PARENDAMISEKS	Tuuli Käämbre	MUU; koostööleping	2015	2015	52 322,40 EUR
3.2.1001.11-0027	Investigation of bioenergetic properties of human colorectal and breats cancer for treatment and diagnostics	Igor Ševtšuk	MUU; TeRve programm	2012	2015	244 800,00 EUR
ETF8987	Bioenergetic profile determination in cancer diagnosis and treatment.	Tuuli Käämbre	ETF	2012	2015	69 600,00 EUR
IUT23-1AP14	Väikesemahulise teaduse infrastruktuuri kaasajastamine teadusteema IUT23-1 raames	Tuuli Käämbre	AP	2014	2015	63 992,00 EUR

Number	Project title in Estonian	Principal investigator	Finance program	Start Year	End Year	Total
IUT23-5AP14	Väikesemahulise teaduse infrastruktuuri kaasajastamine teadusteema IUT23-5 raames	Anne Kahru	AP	2014	2015	63 935,00 EUR
KBFI,MG-10	Development of reference methods for hazard identification, risk assessment and LCA of engineered nanomaterials (NANOVALID)	Anne Kahru	MUU; EC, 7th Framework Program	2011	2015	234 913,00 EUR
TAP19-1	KBFI biopoole teadusaparatuuri kaasajastamine: nanotoksikoloogia	Anne Kahru	TAP	2011	2015	156 143,76 EUR
SF0690063s08	Mechanisms and interactions in toxicology and toxinology: in vitro models	Anne Kahru	SF	2008	2013	1 126 446,52 EUR
ETF9001	Metal-based nanoparticles toxicity assessment in vitro: Saccharomyces cerevisiae model	Kaja Kasemets	ETF	2012	2015	48 000,00 EUR
ETF6956	Bioavailability and (eco)toxicity of metal oxide nanoparticles: effects and mechanisms	Anne Kahru	ETF	2007	2010	54 053,92 EUR
Grant agreement no: 309314	MODeling the EnviRonmental and human health effects of Nanomaterials (MODERN)	Anne Kahru	MUU; FP7-NMP-2012-SMALL-6; Grant agreement no: 309314	2013	2015	160 280,00 EUR
IUT23-5	Nano(eco)toxicology and beyond (ToxBe)	Anne Kahru	IUT	2014	2019	885 200,00 EUR
3.2.0801.11-0026	Effect of pharmaceuticals and engineered nanoparticles on the wastewater treatment and antibiotic resistance gene transfer in the environment	Kaja Kasemets	MUU	2012	2015	116 842,00 EUR

Number	Project title in Estonian	Principal investigator	Finance program	Start Year	End Year	Total
KBFI,KTL-2	Design and application of novel levansucrase catalysts for the production of functional food ingredients (Functional Food Ingredients, FFI)	Angela Ivask	MUU; Biotehnoloogia teadus- ja arendustegevuse toetamine	2012	2015	443 310,11 EUR
ETF7251	Biomedically important proteins and peptides from snake venoms	Jüri Siigur	ETF	2007	2010	54 053,92 EUR
ETF9458	Snake venom nucleases, nucleotidases and phosphatases. Structure-function relationships	Ene Siigur	ETF	2012	2015	48 508,80 EUR
ETF8899	Snake venom proteins and peptides as modulators of biological processes	Jüri Siigur	ETF	2011	2014	48 000,00 EUR

Doctoral studies

	2010	2011	2012	2013	2014	2015
Number of enrolled doctoral students in the corresponding field as of 10 November 201x)	16	20	19	19	21	21
Number of doctoral graduates in calendar year engaged in the corresponding R&D field	1	4	1	2	1	1
The number of staff with PhD level degree	24	26	28	30	30	29
Number of staff listed in the Estonian Research Information System as doctoral thesis supervisors	6	9	12	13	13	16
Number of supervised doctoral students in the Estonian Research Information System	16	20	19	19	21	21

R&D relation to doctoral studies in the corresponding field

Although NICPB is not a degree granting institution, PhD level and younger students are essential for our research. While doing their research under the supervision of NICPB's scientists and working in the laboratories of NICPB, the students are affiliated with universities. NICPB has collaboration agreements with the Tallinn University of Technology, the University of Tartu and Tallinn University and we see this as a valuable opportunity that brings us into contact with bright students while all the universities have access to our research facilities.

The high quality and interdisciplinary research attracts both undergraduate and graduate students to NICPB. Institute introduces its work regularly in other research and degree-granting institutions, in specialised literature, scientific conferences and public media. During the evaluation period NICPB scientists have supervised total of 13 graduated PhD students in (nano)ecotoxicology and in vitro toxicology topics, chemical physics and bioenergetics, the corresponding numbers are filled in the row "Number of doctoral graduates in calendar year engaged in the corresponding R&D field". The "number of enrolled doctoral students in the corresponding field as of 10 November 201x" is the total number of PhD students who were supervised by NICPB scientists. The Number of supervised doctoral students in the Estonian Research Information System is larger, as this field is automatically filled by the system and contains names whose relation to NICPB is not obvious.

In Lab of Environmental Toxicology in the time-frame of 2010-2015 altogether 6 PhD and in Lab of Bioenergetics 3PhD degrees were defended. Today 9 PhD students in Lab of Environmental Toxicology and 6 phD students in the laboratory of Bioenergetics are supervised. NICPB differently from the Estonian Universitites, cannot award PhD and MSc Degrees. Some students will be supervised in collaboration with the universities from abroad.

Outcomes of the R&D

Number of publications and their classification according to Estonian Research Information System

	1.1.	**1.2.**	1.3.	2.3.	**3.1.**	3.2.	3.4.	3.5.	4.1.	5.1.	5.2.	6.3.	6.4.	6.6.	**Total**	**High-level publications**
2010	22	1	0	1	2	3	0	0	0	9	19	1	0	0	58	**25**
2011	20	0	0	2	0	3	1	0	0	7	21	0	1	2	57	**20**
2012	21	0	0	0	1	0	1	0	0	5	14	1	0	0	43	**22**

2013	22	0	2	0	2	1	1	4	0	10	23	4	0	0	69	**24**
2014	28	0	0	0	3	1	2	0	1	14	28	1	0	0	78	**31**
2015	17	1	0	0	0	2	1	0	0	12	13	1	0	0	47	**18**

Number of publications per FTE research and/or teaching staff member

	1.1.	**1.2.**	1.3.	2.3.	**3.1.**	3.2.	3.4.	3.5.	4.1.	5.1.	5.2.	6.3.	6.4.	6.6.	**Total**	**High-level publications**
2010	0,85	0,04	0,00	0,04	0,08	0,12	0,00	0,00	0,00	0,35	0,74	0,04	0,00	0,00	2,25	**0,97**
2011	0,76	0,00	0,00	0,08	0,00	0,11	0,04	0,00	0,00	0,27	0,80	0,00	0,04	0,08	2,16	**0,76**
2012	0,72	0,00	0,00	0,00	0,03	0,00	0,03	0,00	0,00	0,17	0,48	0,03	0,00	0,00	1,48	**0,75**
2013	0,77	0,00	0,07	0,00	0,07	0,03	0,03	0,14	0,00	0,35	0,80	0,14	0,00	0,00	2,41	**0,84**
2014	0,86	0,00	0,00	0,00	0,09	0,03	0,06	0,00	0,03	0,43	0,86	0,03	0,00	0,00	2,39	**0,95**
2015	0,53	0,03	0,00	0,00	0,00	0,06	0,03	0,00	0,00	0,37	0,40	0,03	0,00	0,00	1,46	**0,56**

Impact of scientific articles

NICPB_ Medical and health sciences_Impact of scientific articles.xlsx

Number of industrial property items

	2010	2011	2012	2013	2014	2015	**Total**
Trademark	0	0	0	0	0	0	0
Other ...	0	0	0	0	0	0	0
Utility model	0	0	0	0	0	0	0
Sort	0	0	0	0	0	0	0
Invention	0	0	0	0	0	0	0

R&D outcomes with highest impact durning 2010-2015 (assessment by the institution) (30)

1.1. Scholarly articles indexed by Web of Science Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index and/or indexed by Scopus (excluding chapters in books)

Ivask, A.; Titma, T.; Visnapuu, M.; Vija, H.; Kakinen, A.; Sihtmae, M.; Pokhel, S.; Madler, L.; Heinlaan, M.; Kisand, V.; Shimmo, R.; Kahru, A. (2015). Toxicity of 11 Metal Oxide Nanoparticles to Three Mammalian Cell Types In Vitro. Current Topics in Medicinal Chemistry, 15 (18), 1914−1929, 10.2174/1568026615666150506150109.	Fail_2015_toxicity of 11 metal oxides_Curr Topics Med Chem_15_1-16 SI.pdf	(public)
Ivask, A., Voelcker, N.H., Seabrook, A.A., Hor, M., Kirby, J.K., Fenech, M., Davis, T.P., Ke P.C. (2015). DNA Melting and Genotoxicity Induced by Silver Nanoparticles and Graphene. Chemical Research in Toxicology, 28, 5, 1023−1035, 10.1021/acs.chemrestox.5b00052.		
Tepp, K.; Mado, K.; Varikmaa, M.; Klepinin, A.; Timohhina, N.; Shevchuk, I.; Chekulayev, V.; Kuznetsov, A. V.; Guzun, R.; Kaambre, T. (2014). The role of tubulin in the mitochondrial metabolism and arrangement in muscle cells. Journal of Bioenergetics and Biomembranes, 46, 421−434.	Tepp-2014-The%20role%20of%20tubulin.pdf	(restricted)
Anmann, Tiia; Varikmaa, Minna; Timohhina, Natalja; Tepp, Kersti; Shevchuk, Igor, Chekulayev, Vladimir'; Saks, Valdur; Kaambre, Tuuli. (2014). Formation of highly organized intracellular structure and energy metabolism in cardiac muscle cells during postnatal development of rat heart. Biochimica et Biophysica Acta-Bioenergetics, 1837 (8), 1350−1361, 10.1016/j.bbabio.2014.03.015.	anmann_2014.pdf	(restricted)
Ivask, A.; Kurvet, I.; Kasemets, K.; Blinova, I.; Aruoja, V.; Suppi, S.; Vija, H.; Käkinen, A.; Titma, T.; Heinlaan, M.; Visnapuu, M.; Koller, D.; Kisand, V.; Kahru, A. (2014). Size-dependent Toxicity of Silver Nanoparticles to Bacteria, Yeast, Algae, Crustaceans and Mammalian Cells in Vitro. PLoS ONE, 9 (7), e102108.	Fail_2014_Ivask et al_PLOS One_size dependent + SI.pdf	(public)
Guzun, Rita; Kaambre, Tuuli; Bagur, Rafaela; Grichine, Alexei; Usson, Yves; Varikmaa, Minna; Anmann, Tiia; Tepp, Kersti; Timohhina, Natalja; Shevchuk, Igor; Chekulayev, Vladimir; Boucher, Francois; Dos Santos, Pierre; Schlattner, Uwe; Wallimann, Theo; Kuznetsov, Andrey; Dzeja, Petras; Aliev, Mayis; Saks, Valdur (2015). Modular organization of cardiac energy metabolism: energy conversion, transfer and feedback regulation. Acta Physiologica, 213 (1), 84−106, 10.1111/apha.12287.	apha_12287_Rev_EV.pdf	(restricted)
Ivask, Angela; ElBadawy, Amro; Kaweeteerawat, Chitrada; Boren, David; Fischer, Heidi; Ji, Zhaoxia; Chang, Chong Hyun; Liu, Rong; Tolaymat, Thabet; Telesca, Donatello; Zink, Jeffrey I.; Cohen, Yoram; Holden, Patricia Ann; Godwin, Hilary A. (2014). Toxicity Mechanisms in Escherichia coli Vary for Silver Nanoparticles and Differ from Ionic Silver. ACS Nano, 8 (1), 374−386, 10.1021/nn4044047.	Fail_Ivask et al_2014.pdf	(restricted)

Ivask, Angela; Juganson, Katre; Bondarenko, Olesja; Mortimer, Monika; Aruoja, Villem; Kasemets, Kaja; Blinova, Irina; Heinlaan, Margit; Slaveykova, Vera; Kahru, Anne. (2014). Mechanisms of toxic action of Ag, ZnO and CuO nanoparticles to selected ecotoxicological test organisms and mammalian cells in vitro: a comparative review. Nanotoxicology, 8, 57−71.	Fail_2014_Ivask et al_Mechanisms of toxic action of Ag, ZnO and CuO nanoparticles to selected ecotoxicological test organisms and mammalian cells in vitro_Nanotoxicology SI.pdf	(restricted)
Visnapuu, M.; Joost, U.; Juganson, K.; Künnis-Beres, K; Kahru, A.; Kisand, V.; Ivask, A. (2013). Dissolution of Silver Nanowires and Nanospheres Dictates Their Toxicity to Escherichia coli. BioMed Research International, 1−9, 10.1155/2013/819252.	Fail_Visnapuu et al 2013.pdf	(public)
Käkinen A., Ding F., Chen P., Mortimer M., Kahru A. and Ke PC. (2013). Interaction of firefly luciferase and silver nanoparticles and its impact on enzyme activity. Nanotechnology, 24 (345101), 1−9, 10.1088/0957-4484/24/34/345101.	Fail_2013_Luciferase_IOP_Nanotechnology_published + SI.pdf	(restricted)
Kaambre, Tuuli; Chekulayev, Vladimir; Shevchuk, Igor; Tepp, Kersti; Timohhina, Natalja; Varikmaa, Minna; Bagur, Rafaela; Klepinin, Aleksandr; Anmann, Tiia; Koit, Andre; Kaldma, Andrus; Guzun, Rita; Valvere, Vahur; Saks, Valdur (2013). Metabolic Control Analysis of Respiration in Human Cancer Tissue. Frontiers in Physiology, 4, 1−6, 10.3389/fphys.2013.00151.	Fail_Kaambre_2013_fphys-04-00151.pdf	(public)
Bondarenko, O.; Juganson, K.; Ivask, A.; Kasemets, K.; Mortimer, M.; Kahru, A. (2013). Toxicity of Ag, CuO and ZnO nanoparticles to selected environmentally relevant test organisms and mammalian cells in vitro: a critical review. Archives of Toxicology, 84, 1181−1200, DOI10.1007/s00204-013-1079-4.	Fail_Bondarenko et al_Arch Toxicol (2013) 87_1181-1200_Springerist SI.pdf	(restricted)
Bondarenko, Olesja; Ivask, Angela; Käkinen, Aleksandr; Kurvet, Imbi; Kahru, Anne (2013). Particle-cell contact enhances antibacterial activity of silver nanoparticles. PLoS ONE, 8 (5), e64060.	Fail_2013_Bondarenko et al_PLOS One 8(6)_e6460+SI.pdf	(public)
Kasemets, K., Suppi, S., Künnis-Beres, K., Kahru, A. (2013). Toxicity of CuO Nanoparticles to Yeast Saccharomyces cerevisiae BY4741 Wild-Type and Its Nine Isogenic Single-Gene Deletion Mutants. Chemical Research in Toxicology, 26 (3), 356−367.	Fail_2013_Kasemets et al_Chem. Res. Toxicol. 2013, 26, 356−367 + SI.pdf	(restricted)
Aliev, M., Guzun, R., Karu-Varikmaa, M., Kaambre, T., Wallimann, T., Saks, V. (2011). Molecular system bioenergics of the heart: experimental studies of metabolic compartmentation and energy fluxes versus computer modeling. International Journal of Molecular Sciences, 12 (12), 9296−9331, 10.3390/ijms12129296.	Fail_Aliev-2011-Molecular System Bio.pdf	(restricted)

Käämbre, T.; Chekulayev, V.; Shevchuk, I.; Karu-Varikmaa, M.; Timohhina, N.; Tepp, K.; Bogovskaja, J.; Kütner, R.; Valvere, V.; Saks, V. (2012). Metabolic control analysis of cellular respiration in situ in intraoperational samples of human breast cancer. Journal of Bioenergetics and Biomembranes, 44 (5), 539−558, DOI:10.1007/s10863-012-9457-9.	Fail_JBB_2012.pdf	(restricted)
Bondarenko, O., Ivask, A., Käkinen, A., Kahru, A. (2012). Sub-toxic effects of CuO nanoparticles on bacteria: Kinetics, role of Cu ions and possible mechanisms of action. Environmental Pollution, 169, 81−89.	Fail_20112_Sub-toxic effects of CuO nanoparticles on bacteria_Bondarenko+SI.pdf	(restricted)
Guzun, R.; Gonzalez-Granillo, M.; Karu-Varikmaa, M.; Grichine, A.; Usson, Y.; Käämbre, T.; Guerrero-Roesch, K.; Kuznetsov, A.; Schlattner, U.; Saks, V. (2012). Regulation of respiration in muscle cells in vivo by VDAC through interaction with the cytoskeleton and MtCK within Mitochondrial Interactosome. Biochim Biophys Acta, 1818, 1545−1554, DOI:10.1016/j.bbamem.2011.12.034.	Fail_Guzun_Regulation_2012.pdf	(public)
Ivask, Angela; Suarez, Elizabeth; Patel, Trina; Boren, David; Ji, Zhaoxia; Holde, Patricia; Telesca, Donatello; Damoiseaux, Robert; Bradley, Kenneth, A.; Godwin, Hilary (2012). Genome-Wide Bacterial Toxicity Screening Uncovers the Mechanisms of Toxicity of Cationic Polystyrene Nanomaterials. Environmental Science & Technology, 46 (4), 2398−2405, 10.1021/es203087m.		
Gonzalez-Granillo, M.; Grichine, A.; Guzun, R.; Ussov, Y.; Tepp, K.; Chekulayev, V.; Shevchuk, I.; Karu-Varikmaa, M.; Kuznetsov, A.V.; Grimm, M.; Saks, V.; Käämbre, T. (2012). Studies of the role of tubulin beta II isotype in regulation of mitochondrial respiration in intracellular energetic units in cardiac cells. Journal of Molecular and Cellular Cardiology, 52, 437−447, DOI:10.1016/j.yjmcc.2011.07.027.	Fail_Gonzalez-Granillo.pdf	(restricted)
Saks, V.; Kuznetsov, A.V.; Gonzalez-Granillo, M.; Tepp, K.; Timohhina, N.; Karu-Varikmaa, M.; Käämbre, T.; Santos, P.D.; Boucher, F.; Guzun, R. (2012). Intracellular energetic Units regulate metabolism in cardiac cells. Journal of Molecular and Cellular Cardiology, 419−436, DOI:10.1016/j.yjmcc.2011.07.015.	Fail_V. Saks article.pdf	(restricted)
Tepp, K.; Shevchuk, I.; Chekulayev, V.; Timohhina, N.; Kuznetsov, A.V.; Guzun, R.; Saks, V.; Käämbre, T. (2011). High efficiency of energy flux controls within mitochondrial interactosome in cardiac intracellular energetic units. Biochimica et Biophysica Acta, 1807 (12), 1549−1561.	Fail_BBABIO_46756[1]_ proof.pdf	(restricted)
Guzun, R.; Timohhina, N.; Tepp, K.; Gonzalez-Granillo, M.; Shevchuk, I.; Chekulayev, V.;		

Kuznetsov, A.V.; Käämbre, T.; Saks, V.A. (2011). Systems bioenergetics of creatine kinase networks: physiological roles of creatine and phosphocreatine in regulation of cardiac cell function. Amino Acids, 40, 1333−1348.	Fail_Guzun_Review.pdf	(public)
Kahru, A.; Savolainen, K. (2010). Potential hazard of nanoparticles: from properties to biological and environmental effects. Toxicology, 269, 89−91.	Fail_2010_Kahru and Savolainen_Toxicology 269(2-3)_89–91.pdf	(restricted)
Saks, Valdur; Guzun, Rita; Timohhina, Natalja; Tepp, Kersti; Varikmaa, Minna; Monge, Claire; Beraud, Nathalie; Käämbre, Tuuli; Kuznetsov, Andrey; Kadaja, Lumme; Eimre, Margus; Seppet, Enn. (2010). Structure–function relationships in feedback regulation of energy fluxes in vivo in health and disease: Mitochondrial Interactosome. Biochimica et Biophysica Acta, 1797, 678−697.	Fail_Saks-2010-Structure-function r.pdf	(public)
Kahru, Anne; Dubourguier, H.-C. (2010). From ecotoxicology to nanoecotoxicology. Toxicology, 269, 105−119, 10.1016/j.tox.2009.08.016.	Fail_2010_Kahru and Dubourguier_From ecotoxicology to nanoecotoxicology_Toxicology 269(2-3)_105-119_Sci Dir.pdf	(public)
Mortimer, Monika; Kasemets, Kaja; Kahru, Anne (2010). Toxicity of ZnO and CuO nanoparticles to ciliated protozoa Tetrahymena thermophila. Toxicology, 269, 182−189, 10.1016/j.tox.2009.07.007.	Fail_2010_Mortimer et al_Toxicology_269_182–189_Sci Dir.pdf	(restricted)

3.1. Articles/chapters in books published by the publishers listed in Annex (including collections indexed by the Thomson Reuters Book Citation Index, Thomson Reuters Conference Proceedings Citation Index, Scopus)

Aon, M. A.; Lloyd, D.; Saks, V. (2014). From Physiology, Genomes, Systems, and Self-Organization to Systems Biology: The Historical Roots of a Twenty-First Century Approach to Complexity. In: Aon, Miguel A.; Saks, Valdur; Schlattner, Uwe (Ed.). Systems Biology of Metabolic and Signaling Networks (3−17). Springer-Verlag Heidelberg.	Chapter%201%2C%20From%20Physiology%2C%20Genomes%2C%20Systems%2C%20.pdf	(restricted)
Saks, V.; Schlattner, U.;Tokarska-Schlattner, M.; Wallimann, T.; Bagur, R.; Zorman, S.; Pelosse, M.; Dos Santos, P.; Boucher, F; Kaambre, T.; Guzun, R. (2014). Systems Level Regulation of Cardiac Energy Fluxes Via Metabolic Cycles: Role of		

Creatine,Phosphotransfer Pathways, and AMPK Signaling. In: Aon, Miguel A.; Saks, Valdur; Schlattner, Uwe (Ed.). " SYSTEMS BIOLOGY OF METABOLIC AND SIGNALING NETWORKS: ENERGY, MASS AND INFORMATION TRANSFER." (261−320). Heidelberg: Springer-Verlag Berlin. (Springer Series in Biophysics; 16).	Chapter%2011_2014.pdf	(restricted)
Monge, Claire; Guzun, Rita; Tepp, Kersti; Timohhina, Natalja; Varikmaa, Minna; Sikk, Peeter; Käämbre, Tuuli; Saks, Valdur (2010). Mitochondrial Interactosome in Health and Disease: Structural and Functional Aspects of Molecular System Bioenergetics of Muscle and Neuronal Cells. In: Oliver L. Svensson (Ed.). Mitochondria: Structure, Functions and Dysfunctions (441−470). Nova Science Publisher Inc..	Fail_Nova_Sci_Publ-Saks-PC.pdf	(restricted)

R&D outcomes with highest impact (assessment by the institution)

All the results of the laboratory of bioenergetics are interdisciplinary, containing the aspects of biomedicine, biophysics and biochemistry. During the time period 2010-2015 the i) most important result is formulation of the protein supercomplex Mitochondrial Interactosome involved into cellular energy transfer systems and changes in this supercomplex in health and disease. ii) The Laboratory of Bioenergetics started studies on the developing field of cancer system bioenergetics (http://novaator.err.ee/v/fa231d4a-f920-47b8-aae4-730e434893c1) in clinical samples. The applied research in the field of cancer bioenergetics is started in collaboration with small enterprise Mitogro and with three biggest hospitals in Tallinn. iii) Laboratory published more than 40 papers (ISI WoS). One paper is in the top 1% of the academic field of Biology and Biochemistry (prof. V. Saks).

The research into (nano)ecotoxicology of metal oxide nanoparticles initiated in NICPB at 2006 is highly visible in the international level: the (nano)safety research direction has resulted in (i) publishing in the time-frame of 2010-2015 more than 60 publications (ISI WoS) that have been cited 1700 times, 27 cites/paper; (ii) successful participation of NICPB in the FP6 and FP7 (nano)safety projects of the EC (FP6 OSIRIS, FP7 NanoValid, FP7 MODERN). (iii) Drs A. Kahru and A. Ivask belong to the top 1% most cited scientists worldwide in the area Environment/Ecology and A. Kahru and K. Kasemets in the field of Pharmacology & Toxicology (ISI-ESI). (iv) Estonian state science award "Ecotoxicology and toxicity mechanisms of synthetic nanoparticles", A. Kahru, 2011. (v) Six PhD degrees defended on this topic (M. Heinlaan, V. Aruoja, M. Sihtmäe, M. Mortimer, O. Bondarenko, A. Käkinen, (vi) active participation in work

and STSMs in several COST projects (ENTER, MODENA, CILIATES, NOTICE).

Highest societal impact of research (assessment by the institution)

1) The societal impact of these topics would also have an effect on the progression of Estonian medical and clinical sciences due to the possibilities to use of interdistciplinary competencies of NICPB. In Estonia, especially in Tallinn, the gap between doctors working in the clinics and academic scientists is large. Clinicians are performing their clinical activities and no extensive collaboration with scientists. At the same time scientists perform many potentially clinically relevant findings in laboratory, however the lack of contact with real clinical samples and patient data often results not evolving this findings into practical phase. The collaboration of Laboratory of Bioenergetics with Tallinn biggest hospitals reduces this gap. Our work will incorporate the know-how and opinions of clinicians with the basic scientist's theoretical and experimental knowledge in order to provide a predictive diagnostic system with real clinical value and impact.

2) According to the chemicals regulation in the European Union (REACH) all chemical substances produced in excess of 1 tons per year (estimated number exceeds 100 000) have to be characterized in terms of toxicity. It is a considerable burden for the European chemical industry (including Estonian chemical industry), since the responsibility of assessments lies on the manufacturer. The nano(eco)toxicological research in NICPB, especially the studies of environmental hazards of metal oxide nanoparticles initiated in 2004 have been groundbreaking in the world as reflected in the number of citations as well as in the successful participation in the FP6 and FP7 projects of the European Union. Due to these activities, there is a considerable amount of aquatic toxicity data for ZnO, CuO and TiO2 'REACH dossiers' in ECHA (European Chemicals Agency) obtained from the papers of Kahru's Lab.

3) Tuuli Käämbre is the member of the advisory council of the national programm TerVe, Horizon 2020 reviewer.

4) Popularization of the chemical safety and biomedicine knowledge in Estonian journals (Keskkonnatehnika, Inseneeria, Horisont, Eesti Arst)

5) M. Heinlaan was supervisor of the nanomaterials group-work and Tuuli Käämbre the reviewer of the student's articles in "Talveakadeemia 2014". Both laboratories have been organized public events aimed at popularizing science like "Teadlaste öö".

6) NICPB supports Estonian Society of Toxicology (50 members, president A. Kahru). NICPB scientists are active in ETS, EUROTOX and IUTOX.

7) M. Heinlaan was supervisor of the nanomaterials group-work and Tuuli Käämbre the reviewer of the student's articles in "Talveakadeemia 2014". Both laboratories have been organized public events aimed at popularizing science like "Teadlaste öö".

8) Creation of the open database on nanosafety. Juganson et al. (2015) NanoE-Tox: J. Nanotech. 6, 1788-1804.4) A. Kahru, Swiss NSF Programme “Opportunities and Risks of Nanomaterials”, evaluator

Significant additional facts which indicate the sustainability and potential of R&D (assessment by the institution)

During the past years the Institute has slightly grown in size but at the same time has also been rejuvenated. At the end of 2010, the Institute employed 113 people with the average age of 53 years, whereas at staring of 2015 we were 124-strong with the average age of 47 years. Laboratory of Bioenergetics has published close to 90 papers. Tuuli Käämbre has been nominated to the state science award in the field of Medicine (2015). 6 PhD degrees defended their thesis and currently 6 PhD students preparing their doctoral theses in the frames of topics involved into bioenergetics and biomedicine. 3 PhD students made a part of their experimental work at the Laboratory of Fundamental and Applied Bioenergetics (University of Grenoble-Alpes), the studies of two PhD has been performed in the at Mayo Clinic, Division of Cardiovascular Research. However, high-quality interdisciplinary research capacities have attracted many students at PhD, MSc and BSc level. The researches of the laboratory actively search additional possibilities of financing for experimental work.

The interdisciplinary research/facilities of NICPB promoted success of the research into nano(ecotoxicology) of nanoparticles since 2006. NCIPB nanotoxicologists have published close to 90 papers, cited 3500 times (40 cites/paper), involving 9 highly cited papers (ISI-ESI). The research has been recognised by Estonian state science award (A. Kahru, 2011) and Academy of Sciences research professor grant for years 2016-2019 (A. Kahru). 8 PhD degrees defended and currently 9 PhD students work in the (nano)ecotoxicology and in vitro toxicology topics. Altogether 6 young researchers have been successful in obtaining post-doc grants in top level international laboratories in Switzerland, US, Australia, Sweden and Italy – most of them have returned to NICPB and started new research directions (via PUT funding; O. Bondarenko, A. Ivask, M. Heinlaan). Cooperation with the Estonian Universities has resulted in funding of the roadmap grant NAMUR+ providing new equipment, 400000 Eur.

Confirmations

Role	Name of the confirmer	Institution / Structural unit	Date of validation
Principal investigator	Urmas Nagel		14.02.2017 11:28:10
Confirmer	Kristian Sülluste	Keemilise ja Bioloogilise Füüsika Instituut	14.02.2017 11:31:51