

TOP SCIENTIFIC ACHIEVEMENTS IN LATVIA,
2011, 2012, 2013

Based on the submissions of universities, scientific institutes, and research centres, the following most significant scientific achievements in Latvia have been selected by the Latvian Academy of Sciences (LAS):

In 2011*In the field of theoretical science:*

- **Development of new control measures for sustainable development of large power management systems with the corresponding results presented in the monograph *Dynamic Management of Sustainable Development: Methods for Large Technical Systems* (Springer, London).** *Dr.habil.sc.ing.* Zigurds Krišāns, *Dr.sc.ing.* Anna Mutule, LAS Corresponding Member Jurijs Merkurjevs, *Dr.sc.ing.* Irina Oļeinikova, Institute of Physical Energetics and Rīga Technical University.
- **Development of methods of problem analysis and mathematical models for software design, presented in the monograph *Model-Driven Domain Analysis and Software Development: Architectures and Functions* (IGI Global, New York).** LAS Honorary Member Jānis Osis, *Dr.sc.ing.* Ērika Ašņina, Rīga Technical University.
- **Construction of models of inorganic single- and multi-wall nanotubes using linear group formalism and calculation of their properties applying only fundamental constants.** *Dr.chem.* Jurijs Žukovskis, LAS Foreign Member Roberts Evarestovs, Institute of Solid State Physics of the University of Latvia in cooperation with the Saint Petersburg State University.
- **Discovery of new genetic variations of the somatostatin receptor enabling the provision of individual therapy for acromegalic patients.** LAS Corresponding Member Jānis Kloviņš, Ivo Kāpa, Raitis Pečulis, *PhD* Liene Ņikitina-Zaķe, Latvian Biomedical Research and Study Centre; LAS Corresponding Member Valdis Pīrāgs, Darja Ciganoka, Faculty of Medicine of the University of Latvia; Inga Balcere, Andra Valtere, Pauls Stradiņš Clinical University Hospital; Ieva Lase, Rīga Eastern Clinical University Hospital.

- **Accomplishment of research on the urban history of Rīga in the 17th century, based on the cartographic materials from Latvian and foreign archives.** *Dr.hist.* Margarita Barzdeviča, Institute of Latvian History of the University of Latvia.
- **Publication of a study on one of the brands of the Latvian cultural canon in visual arts – artist Kārlis Padegs and his epoch.** *Dr.art.* Jānis Kalnačs, Vidzeme University of Applied Sciences.

In the field of practical applications:

- **Successful accomplishment of the first liver transplantation in Latvia –** under the leadership of LAS full members Jānis Gardovskis and Rafails Rozentāls, Pauls Stradiņš Clinical University Hospital, Rīga Stradiņš University.
- **Successful implementation of the first round of clinical trials of a new therapeutic substance applicable in the treatment of late complications of Parkinson’s disease.** *PhD* Juris Fotins, *Dr.chem.* Aleksandrs Gutcaits, LAS Full Member Ivars Kalviņš, *PhD* Ronalds Zemribo, LAS Corresponding Member Valerjans Kauss, Latvian Institute of Organic Synthesis in cooperation with *Merz Pharmaceuticals*, Germany.
- **Demonstration of the determining role of the amorphous nature of the structure on the localisation of electrons in vitreous silica. This discovery can be applied in the modernisation of electronic memory devices.** *Dr.habil.phys.* Anatolijs Truhins, Institute of Solid State Physics of the University of Latvia.
- **Development of a super-elastic sensor prototype (composite of elastomers and electroconducting nanoparticles) that is applicable in wide-area detection of pressure and impact.** LAS Corresponding Member Māris Knite, *Dr.sc.ing.* Juris Zavickis, Velta Tupureina, Valdis Teteris, Artis Linarts, Gatis Podiņš, Rīga Technical University; Āris Solovjovs, Joint Stock Company “Baltijas Gumijas fabrika”.
- **Accomplishment of a significant research study on national identity and development of the Latvian society presented in the *Human Development Report 2010/2011: National Identity, Mobility, and Capability* –** editors-in-chief *Dr.sc.soc.* Brigita Zepa, *Dr.sc.soc.* Evija Kļave, Advanced Social and Political Research Institute of the University of Latvia.

Development of a new high-yielding summer wheat variety ‘Robijs’ that is particularly suitable for cultivation in the Baltic region. Vija Strazdiņa, Maija Ceraukste, State Stende Cereal Breeding Institute; *Dr.biol.* Dace Grauda, LAS Full Member Īzaks Rašals, Institute of Biology of the University of Latvia.

In 2012

In the field of theoretical science:

- **Elaboration of a new method for the development of quantum algorithms and establishment of a new application of quantum interference in the field of nanoelectronics.** LAS Full Member Andris Ambainis, *PhD/Dr.phys.* Vjačeslavs Kaščejevs, *Dr.sc.comp.* Aleksandrs Belovs, Jānis Timošenko, University of Latvia.
- **Elaboration of new methodology for the synthesis of organic compounds based on the activation of carbon-hydrogen (C—H) bonds. Method can be applied in the synthesis of new therapeutic substances.** Dmitrijs Lubriks, Igors Sokolovs, LAS Corresponding Member Edgars Sūna, Latvian Institute of Organic Synthesis.
- **Introduction of the notion of ultrametric algorithms in computer science by LAS Full Member Rūsiņš Mārtiņš Freivalds with his scientific article “Ultrametric Finite Automata and Turing Machines”, notably broadening the potential of computer science.** University of Latvia.
- **Accomplishment of comprehensive research on the Latvian music during the occupation years (1940–1945) as the less-studied and most ideology-laden period of time.** Corresponding author and editor *Dr.art.* Arnolds Klotiņš, Institute of Literature, Folklore, and Art of the University of Latvia.
- **Accomplishment of a study on the earliest settlement of Latvia during the Paleolithic – 10 500–9200 BC, based on unique, first-hand materials.** *Dr.hist.* Ilga Zagorska, Institute of Latvian History of the University of Latvia.

In the field of practical applications:

- **Development of new catalytic methods for the production of glycerine acid and lactic acid by means of oxidising glycerine with air or molecu-**

- lar oxygen. Development of a new method for the synthesis of more active and more selective catalysts.** *Dr.chem.* Svetlana Čornaja, LAS Full Member Valdis Kampars, *Dr.sc.ing.* Ēriks Palčevskis, *Dr.chem.* Lidija Kuļikova, *Dr.chem.* Vera Serga, *Dr.chem.* Svetlana Žižkuna, Konstantīns Dubencovs, Olga Stepanova, Elina Sproģe, Antons Cvetkovs, Rīga Technical University.
- **Discovery of new cancer-specific autoantibodies for early diagnostics of gastric cancer and forecasting progress of the disease.** LAS Corresponding Member Aija Linē, *Dr.biol.* Karina Siliņa, *Dr.biol.* Pāvels Zajakovs, *Dr.biol.* Zane Kalniņa, Irēna Meistere, Angelina Pismennaja, Latvian Biomedical Research and Study Centre; LAS Corresponding Member Mārcis Leja, Guntis Ancāns, University of Latvia; in cooperation with the Otto von Guericke University Magdeburg, Germany.
 - **Discovery of the possibility for crystalising chalcogenide coatings for nanotechnology and nanoelectronics with the help of electron beams for application in electron lithography.** *Dr.phys.* Vjačeslavs Gerbreders, *Dr.phys.* Oksana Šimane, Daugavpils University; *Dr.phys.* Arnis Gulbis, Rīga Technical University.
 - **Breeding of the variety of the Japanese quince ‘Rasa’ for fruit production.** The yield capacity, cold resistance, non-thorny kind, big and easy to collect fruit, and the high-quality biochemical composition of the new variety along with the elaborated methods of fruit processing provides new opportunities for the development of farmsteads. *Dr.agr.* Silvija Ruisa, LAS Corresponding Member Dalija Segliņa, Latvia State Institute of Fruit-Growing.
 - **Accomplishment of a study on emigration trends and its driving forces in Latvia and Estonia between 2000–2010.** *Dr.math.* Mihails Hazans, University of Latvia.

In 2013

In the field of theoretical science:

- **Outstanding results in the quantum computing theory.** LAS Full Member Andris Ambainis (LAS Grand Medal, Advanced Grant by the European

Research Council awarded to 300 top researchers in Europe), University of Latvia.

- **Comprehensive research conducted in the field of cell biology and in the investigation of the molecular basis of malignant tumours opening up fundamentally novel ways for cancer treatment.** LAS Full Member Jekaterina Ērenpreisa (Award of the Cabinet of Ministers of the Republic of Latvia in 2013), Latvian Biomedical Research and Study Centre.
- **Development of the theory of quantum pumps and its application in the field of nanoelectronics used in the key meteorological laboratories in Europe.** LAS Corresponding Member Vjačeslavs Kaščejevs (the only researcher from Eastern Europe to be nominated in the Young Scientists class of 2013 by the World Economic Forum), University of Latvia.
- **Accomplishment of a long-term study as part of a thematically united cycle of monographs on the culture of nations dwelling at the coastal area of the Baltic Sea, treating *sea* and its elements as an important part of the identity of people presented in the monograph *Jūra latviešu valodā un folklorā: etnolingvistiskais aspekts* [Sea in the Latvian Language and Folklore: Ethnolinguistic Aspect].** LAS Corresponding Member Benita Laumane, Liepāja University.

In the field of practical applications:

- **Accomplishment of chemical and experimental study of a new original cardioprotective drug candidate allowing to proceed with clinical trials of this substance.** LAS Full Member Maija Dambrova, *Dr.chem.* Solveiga Grinberga, LAS Full Member Ivars Kalviņš, *Dr.pharm.* Jānis Kūka, *Dr.pharm.* Edgars Liepiņš, *Dr.chem.* Daina Loža, *Dr.chem.* Einārs Loža, LAS Corresponding Member Osvalds Pugovičs, *Dr.pharm.* Reinis Vilškersts, Latvian Institute of Organic Synthesis; *Dr.med.* Ilmārs Stonāns, Joint Stock Company „Grindeks”.
- **Development and introduction of new compositions of dietary supplements containing natural glycopeptides applicable in the field of oncology and virology.** *Dr.sc.ing.* Jevgēņijs Jermolajevs, Lilija Peškova, Guntis Vītols, *Dr.med.* Simona Doniņa, Augusts Kirhenšteins Institute of Microbiology and Virology of the Rīga Stradiņš University.

- **Accomplishment of the synthesis and study of organic glasses with original structure for application in photonics equipment.** LAS Corresponding Member Valdis Kokars, LAS Full Member Valdis Kampars, Kaspars Traskovskis, Elmārs Zariņš, Lauma Laipniece, Rīga Technical University; *Dr.phys.* Aivars Vembris, Andrejs Tokmakovs, LAS Corresponding Member Mārtiņš Rutkis, Institute of Solid State Physics of the University of Latvia.
- **Accomplishment of research on the mechanism of resistance shift in functional materials enabling the production of terabit memory.** LAS Full Member Juris Purāns, LAS Corresponding Member Aleksejs Kuzmins, LAS Full Member Jevgenijs Kotomins, *Dr.phys.* Aleksandrs Kalinko, Institute of Solid State Physics of the University of Latvia.
- **Development of a new method of optical diagnostics and monitoring and production of devices for non-contact detection of cutaneous melanoma.** LAS Full Member Jānis Spīgulis, *Dr.phys.* Uldis Rubīns, *Dr.phys.* Edgars Kviesis-Kipge, and Oskars Rubenis, University of Latvia.
- **Compilation and publication of *Lielā ķīniešu – latviešu vārdnīca* [*The Big Chinese-Latvian Dictionary*] providing also vast commentary on the cultural history.** LAS *Dr.h.c.* Pēteris Pildegovičs, University of Latvia.
- **Accomplishment of a study on the biologically active substances in food-stuffs upon the application of the latest packing technologies in prepacking and storing ensuring high quality and safe period of use.** *Dr.sc.ing.* Evita Straumīte, *Dr.habil.sc.ing.* Lija Dukaļska, *Dr.sc.ing.* Sandra Muižniece-Brasava, Latvia University of Agriculture.