
Skoltech

Skolkovo Institute of Science and Technology

Annual Report

18

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I am pleased to introduce the Annual Report for 2018, the third year of my presidency.

The speed and scale of development during the period of 2015-2018 required commitment and efforts from our faculty, researchers, engineers, students, alumni, management and stakeholders, all of whom who made Skoltech what it is today.

We are a fully operational international university, attracting for permanent jobs specialists with multi-year experience at the world's leading universities and companies. We have established multidisciplinary teams working in the areas of global science & technology agenda – artificial intelligence, life sciences and health, agro-technologies, photonics & quantum materials, energy efficiency, cutting-edge engineering and advanced materials.

Our reputation for academic & technology excellence was advanced by a number of remarkable results. Let me give you some examples.

An equipment complex for the production of aluminum honeycomb packs, which are used in the aerospace industry, was

successfully developed and delivered to ISS-Reshetnev Company, allowing for the production of materials that were previously imported to Russia. The Enhanced Oil Recovery Lab has secured yearlong R&D contracts with some of the largest companies such as Lukoil, Gazprom Neft, Zarubezhneft, Rosneft, Total, and Schlumberger. Specialists of the Center for Energy Science and Technology have set-up a production line of cathode materials based on lithium-iron-phosphate compounds, outdoing the world's best counterparts by 8-10 %. The materials will serve for advanced batteries of medium and large-scale capacities. The first prototypes of lithium-ion batteries of small capacity (for smartphones) have been designed.

Joint research in genome editing (CRISPR-technologies) with Rutgers, MIT and Harvard led to cutting-edge results protected with three joint patents. The agreement on the joint usage of inventions has already allowed the commercialization of results.

Our publication output is at the level of international young universities, holding top positions in the world university rankings –

President's foreword

KAIST, Nanyang, HKUST – which is clear evidence of the high qualification of our academic personnel and students.

I am proud to say that this year we have seen the highest amount of sponsored research funding; a remarkable 1.1 billion was raised via contracts with leading national and international companies and funding agencies – Airbus, Bosch, Bitfury, Huawei, LG Electronics, Phillips, Total, Volkswagen, AM Munich Research Institute, Horizon 2020, RSF, RFBR and others. More than 2 billion rubles has been secured for the next three years.

In 2018, Skoltech graduated its fourth class. About 50% are employed in Russian high-tech companies (Sberbank, Yandex, Biocad and others), R&D divisions of international companies (Huawei, Cisco), research institutions (Kurchatov, Russian Quantum Center, institutes of the Russian Academy of Sciences). 8% of graduates established their own startups, and 38% are pursuing PhDs, mostly at Skoltech.

We are visible in Russia and abroad. Skoltech scholars are regularly invited

as speakers on the top-international conferences; during the year more than 160 high-profile official delegations, representing foreign ministries, diplomatic missions, international universities and global high tech companies visited our state-of-the-art Campus, located in Skolkovo Innovation Center with unique infrastructure for life and work in the high-tech sector of the Russian economy.

Very recently, Zhores Alferov, a man of great mind and bright personality passed away. Fueled by earnest love for his motherland, he lived a long life full of accomplishments, but above all, he was an outstanding scholar fully devoted to science. He made world-changing discoveries, founded scientific schools and nurtured new talents. He was not only a co-Chair of Skolkovo Scientific Advisory Council, but a true believer of Skolkovo project. This is irreparable loss for all our community.

In the following pages, you will read more about our inspiring results, achieved by individuals and teams – the Skoltech community.



Alexander Kuleshov
Skoltech President



Skoltech in Brief

Mission

Skoltech was founded in 2011 with the vision of being a world-leading academic institute of science and technology.

As an academic institution, Skoltech's primary mission is academic & technology excellence in target domains. This includes performing cutting-edge basic and applied research and educating a next generation of science, technology and business leaders.

Also, as a leading academic institution, Skoltech generates value in the form of industry-funded research and results implementation, new enterprises established by scholars, engineers, students and alumni, technology licensing, services of shared facilities, professional training, and advisory services. Therefore, Skoltech reinforces Russia's technology excellence in target domains and bridges the gap between applied research and industry.

Skoltech forms a part of the Skolkovo community which is creating a new, self-sustaining innovation ecosystem providing an engine for Russian high-tech industry and attracting foreign investments. In this paradigm, Skoltech acts as a catalyst to foster cutting-edge research in the advanced areas of crucial importance for Russia, promote entrepreneurial activity and train internationally competitive specialists capable of working in the rapidly changing research and technology landscape.

Furthermore, Skoltech adopts advanced international practices in research, education, innovation & entrepreneurship, and disseminates them to Russian universities and academic institutions. Thus, in addition to direct monetary return, Skoltech creates significant indirect long-term economic and social impact.



DMITRY MEDVEDEV, *Prime Minister of the Russian Federation:*

“Most of all, I was impressed not even by state-of-the-art equipment or outstanding Campus architecture, but Skoltech spirit and atmosphere, it is unique.”

Snapshot & Trends

Focus

- 6** Target Domains
- 9** Centers for Research, Education & Innovation
- 1** Center for Entrepreneurship & Innovation

Academic Excellence

- 17** MSc and PhD degree programs
- 5.8** papers in Scopus, WoS per faculty
- 0.5** papers in Nature Index journals per faculty headcount
- 68** grants of Horizon 2020, RSF, RFBR
- 65%** growth in grant funding compared to 2017

Human Capital

- 129** faculty
- 229** postdocs & researchers
- 134** engineers & technical staff
- 1000** students from 45 countries
- 400** alumni

Value Generation

- 43** enterprises
- 26** are Sk residents
- 108** R&D contracts
- 99%** growth in R&D contracts funding compared to 2017

Funding secured

- 2 bln Rub** secured under R&D contracts and grants for 2019 – 2022

Facilities

- 136,000 sq.m** state-of-the-art campus

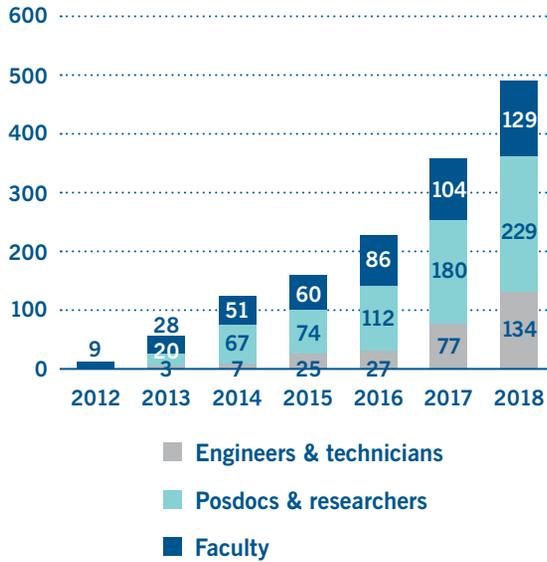
Human capital: data is provided as of the end of 2018.

Academic excellence: data on publication output is extracted from Nature Index, WoS, Scopus as of March 1, 2019. Also see page 29 (Annotation of Institutional KPIs)

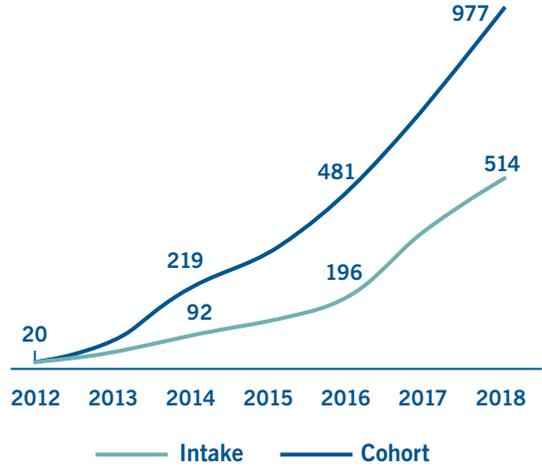
Value generation: enterprises established by Skoltech faculty, researchers, students, alumni (cumulative from 2013). Data on enterprises and R&D contracts as of the end of 2018.

Funding secured: data as of March 1, 2019.

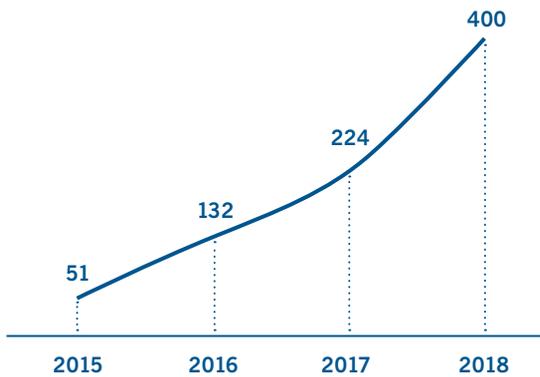
Academic & engineering personnel



MSc and PhD intake, cohort

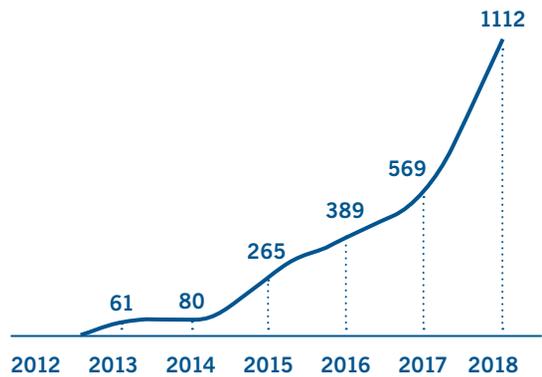


Graduates (cumulative)



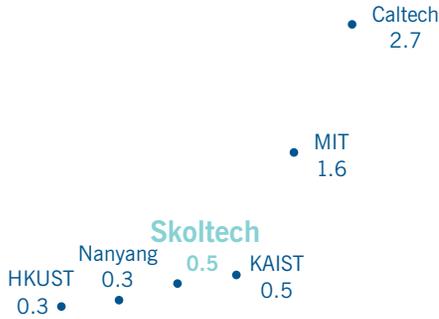
*2015 – Skoltech first graduation

Attracted funding (mln, Rub)

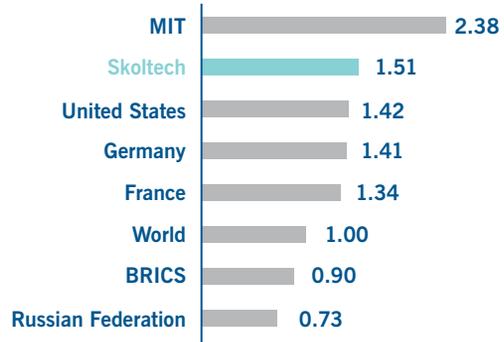


Attracted funding: R&D contracts, grants, consulting services, professional training.

Papers in Nature Index journals by faculty headcount¹ (2018)

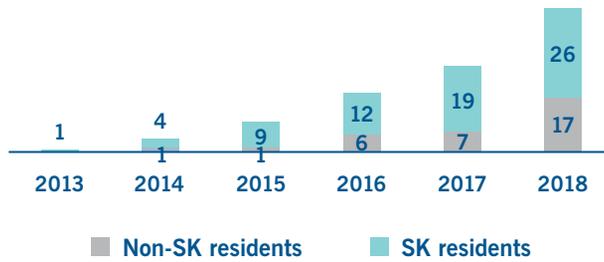


Scopus Field-Weighted Citation Impact² 2015 – 2018

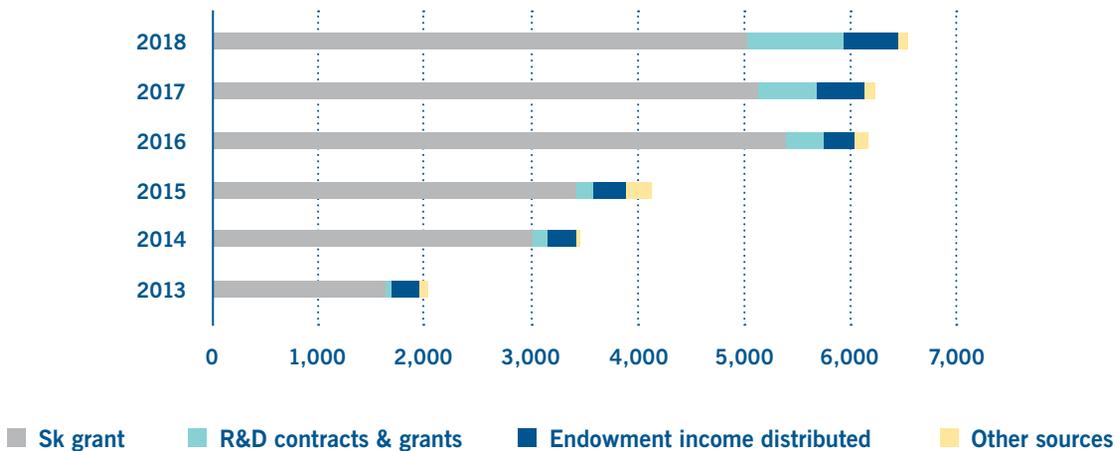


Establishment: MIT (1861), Caltech (1891), KAIST (1971), Nanyang (1991), HKUST (1991), Skoltech (2011)

Skoltech enterprises (cumulative)



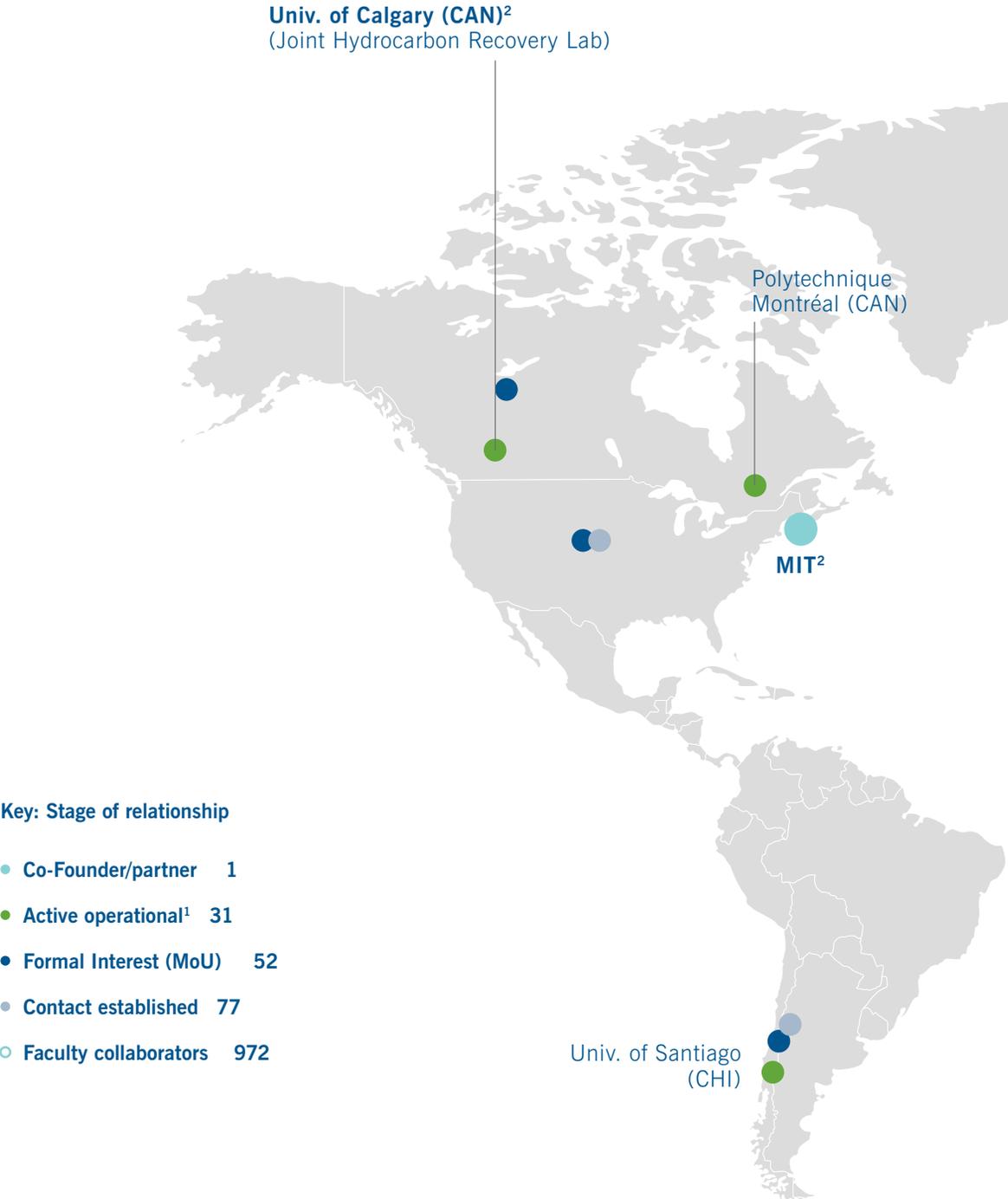
Sources of financing (mln Rub)



¹ Data is provided as of March 1, 2019. Sources: Nature Index, university web pages.

² Indicates how the number of citations received by papers compares to the average number of citations received by all other similar papers index in Scopus (data as of March 1, 2019. SciVal source)

Skoltech Academic Network



Key: Stage of relationship

- Co-Founder/partner 1
- Active operational¹ 31
- Formal Interest (MoU) 52
- Contact established 77
- Faculty collaborators 972

1. E.g., contract, research, academic exchange
 2. Strategic relationship as defined by having: extensive Academic exchange, joint R&D investment, global industrial partners, gateway to other institutions
 Source: Skoltech

Newcastle Univ. (GBR)

Univ. of Southampton (GBR)

Univ. Grenoble (FRA)

DLR (GER)

Univ. Ulm (GER)

TU Munich (GER), (Joint Additive Mfg Lab with Oerlikon)²

Aalto Univ. (FIN)

SPbAU (RUS)

MIPT (RUS)

KFU (RUS)

TPU (RUS)

FEFU (RUS)

Nat'l Science & Tech
Dev. Agency (NSTDA)

Curtin Univ. of Tech. (AUS)

Skoltech

Focus & Governance

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Human Capital



Skoltech teams at the ceremony “Top Team Performance Award 2018”

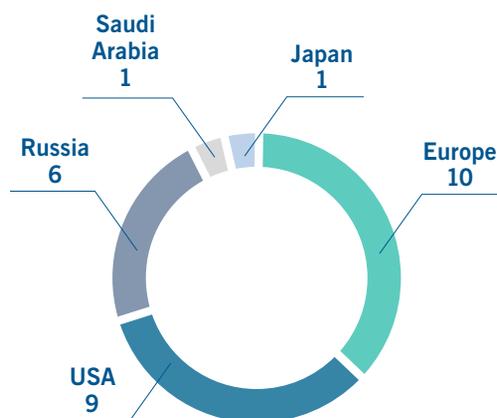
ACADEMIC & ENGINEERING PERSONNEL

The strategic priority of 2018 was to hire ambitious junior faculty from international markets, support the academic career growth of scholars showing outstanding performance and contribution to Skoltech development.

Leveraging favorable environment at Skoltech, **recruitment** efforts through advertisement on the international portals³

and faculty network resulted in applications from Germany, UK, France, Switzerland, USA, Russia, South Korea, China and other countries. Based on the expert review and decisions of the Appointment, Promotion and Tenure Committee of the Skoltech Academic Council, 27 top-candidates became Skoltech faculty.

Geography of faculty hires



Europe: University of Leicester, Universität Hamburg, Helmholtz Institut Jena, Bournemouth University, Aberystwyth University, Fritz-Haber-Institut, Technische Universität Darmstadt, Royal Holloway University of London, University of Southampton, Università degli Studi di Roma “La Sapienza”

USA: Massachusetts Institute of Technology, University of Michigan, University of North Carolina at Charlotte, University of New Jersey, Schlumberger-Doll Research Center, Schlumberger Reservoir Laboratory

Russia: Institute of Bioorganic Chemistry (RAS), Lebedev Physics Institute (RAS), Institute of Physics of the Earth (RAS), Lukoil Engineering, Integra Group

Japan: RIKEN Brain Science Institute

Saudi Arabia: King Abdullah University of Science and Technology

³ www.timeshighereducation.com, www.academicpositions.com, www.nature.com, www.jobs.ac.uk.

Faculty promotions:

- **Prof. Alexey Frolov** promoted to Associate Professor for an impressive track record in attracting industry funding, including two large contracts with Huawei, and contributions to the field of Information Theory.
- **Dr. Alexander Bernstein** promoted to Professor of the Practice for intensive participation in a number of industrial projects (leading one of them), strong publication activity (30 publications over the last four years), and developing an original course on modern statistics.
- **Prof. Georgii Bazykin** promoted to Associate Professor for excellent publication record including in Science, Genome Research, Molecular Biology and Evolution journals, initiation of a number of important research projects, development of original, popular course “Population and Medical Genetics”.
- **Prof. Andrei Osiptsov**, Dr. of Science (Habilitation), promoted to Associate Professor for active development of collaboration with industry, resulting in establishing a joint laboratory with Gazprom Neft. He also demonstrated impressive teaching activities.
- **Prof. Dmitri Koroteev** promoted to Associate Professor for stated immense experience in high-tech segment of oil and gas industry, good publication record, attraction of extensive portfolio of industry-related projects.
- **Prof. Dzimtry Tsetserukou** promoted to Associate Professor for development of original research and educational program in Robotics and active work with students (Intelligent Robotics lab has graduated more than 20 students), leads the reSet team, which became champions of Eurobot Open Russia 2018.

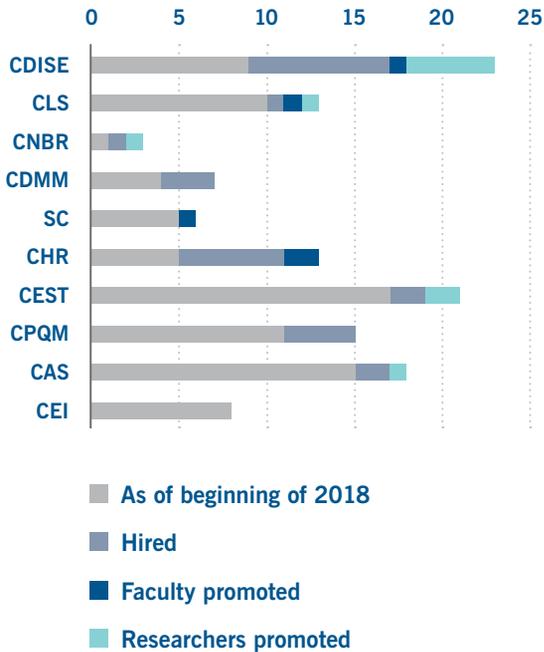
The first cohort of postdocs, having stated outstanding performance and potential, was promoted to Assistant Professorship:

- **Maria Pukalchik** has a balanced combination of industrial and academic experience and work in the area of Digital Agriculture – a breakthrough technology that may finally transform agriculture into industry; not surprisingly, she received five grants as PI from RFBR and RSF.

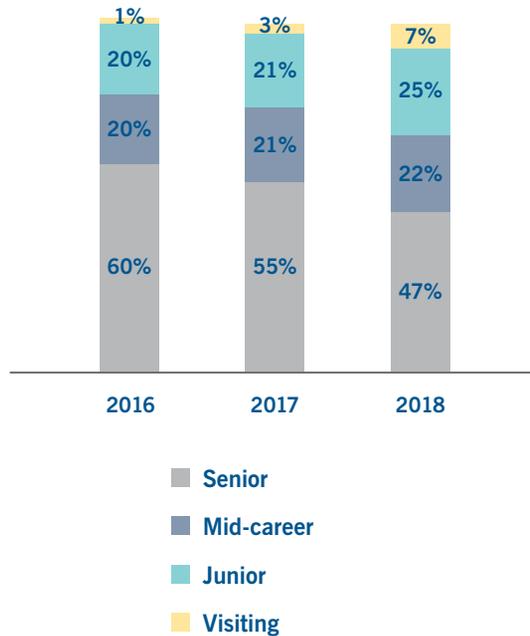
- **Vladimir Palyulin** has impressive postdoc experience, starting as a researcher at Technische Universität München for 5 years, where he received a personal DFG grant, then one year as a research associate and a teaching experience at the Cambridge University.
- **Dmitry Yarotsky**, Dr. of Science (Habilitation), has international experience as a postdoc at University College Dublin and as a Humboldt Fellow in Germany, as well as industrial experience and a strong publication record.
- **Maxim Panov** played a key role in establishing the educational portfolio of the CDISE as coordinator of two MSc programs and one PhD program, plus a balanced combination of industrial and academic experience.
- **Mikhail Belyaev** demonstrated excellence in applications of mathematical and computer science methods in the area of neurobiology, in particular, for classification of structural connectomes.
- **Maria Sokolova** demonstrated teaching excellence by developing the curriculum of the molecular biology laboratory course and summer school on antibiotics; her research on novel RNA polymerases has had a clear basic science value and may provide novel enzymes for biotechnology.
- **Pavlo Gavrylenko** stated a solid publication record in high impactful journals specialized in mathematical physics, a rapid growth of scientific productivity, and impressive teaching experience.
- **Henni Ouerdane** showed an excellent publication record, addressing challenged and elucidated fundamental problems on thermodynamics and coupled transport theory of heat and electricity.
- **Federico Martin Ibanez** demonstrated academic performance in power electronics comparable with international peers; in addition, he contributed to the development of the Skoltech Smart Grids Lab.

As of the end of 2018, Skoltech had 129 professors. The share of junior and mid-career faculty increased by 5% in comparison with the previous year.

Faculty headcount by Centers



Faculty headcount by rank



* For the purpose of calculation, the faculty cohort indicated "as of beginning of 2018" does not include faculty promoted during the year.

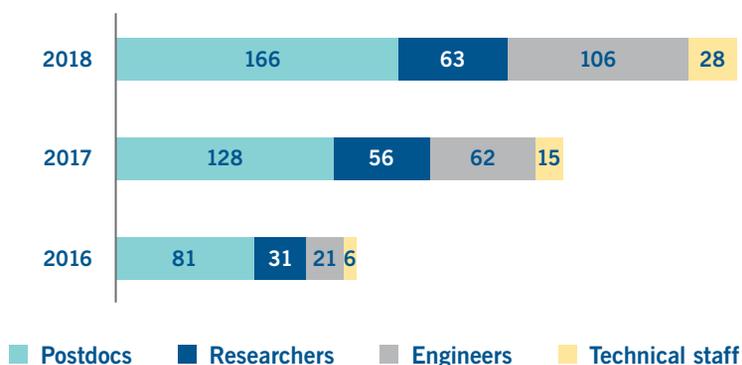
Skoltech **postdocs** and **researchers** supported the CREIs in implementing development plans by conducting R&D and scientific projects, preparing new proposals, and establishing new enterprises. **Engineers** and **technical staff** contributed on a vast majority of laboratory activities, e.g.

selection, installation and commissioning of equipment, design and development of premises and auxiliary sub-systems, maintenance of storage and materials management, developing procedures and protocols on research equipment, and ensuring health and safety requirements.



IVAN OSELEDETS, Associate Professor, recipient of 2018 Presidential Award in Science and Innovation: "Today everyone is talking about digital economy and artificial intelligence. We have a strong scholarly tradition in mathematics and physics, which I believe is underutilized. It would be great to have a "Year of Mathematics," embracing both pure mathematics and computational mathematics, which we are actively working on. This would help us in many ways."

Postdocs, researchers, engineers, technical staff



The year marked a range of **international** and **national** awards:

- **Prof. Ivan Oseledets** received Award of the President of the Russian Federation in the Field of Science and Innovations for Young Scientists for developing breakthrough computational technologies for solving multidimensional tasks in physics, chemistry, biology, and data analysis based on tensor expansions,
- **Prof. Mikhail Finkelberg** was invited as a speaker at the International Mathematical Congress 2018,
- **Prof. Andrzej Cichocki** was awarded by the International Digital Signal Processing Society for his pioneering contributions in multiway signal processing and their applications,
- **Prof. Victor Lempitsky** was honored with the Scopus Awards, Russia, as the most cited scholar in the area of Computer Science,
- **Dr. Mikhail Bershtein** received the Moscow Government Award for Young Scientists for a series of studies on the theory of representations of infinite-dimensional algebras,
- **Dr. Maria Logacheva** received the Moscow Government Award for research accomplishments in the functional and evolutionary genomics and metagenomics of flowering plants,
- **Dr. Sergey Shmakov** received the Moscow Government Award for the discovery of new types of CRISPR-Cas systems and their use in genome editing and other biotechnological applications.
- **Dr. Stanislav Fedotov** won the Energy of Youth Award from the Global Energy Association in the all-Russian contest of youth research projects in the field of energy for development of potassium-ion batteries.



SERGEY SHMAKOV, PhD in Life Sciences and winner of the 2018 Moscow Government Award for Young Scientists:

“Skoltech is a world-class university, which, as proved by our example, allows for making notable discoveries and effectively disseminating them both to academia and industry.”



President of the Russian Federation presenting the Award to Skoltech professor Ivan Oseledets



Winners of the 2018 Moscow Government Award for Young Scientists

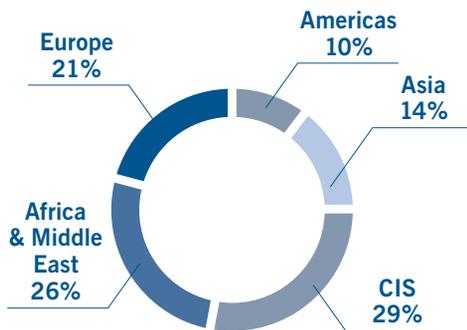
STUDENTS & ALUMNI

In 2018, the **cohort** reached 1000 of regular and visiting students. International enrolments (regular students) from 45 countries made 22% on PhD programs and 17% on MSc programs. In terms of the gender balance, 30% of students are female.

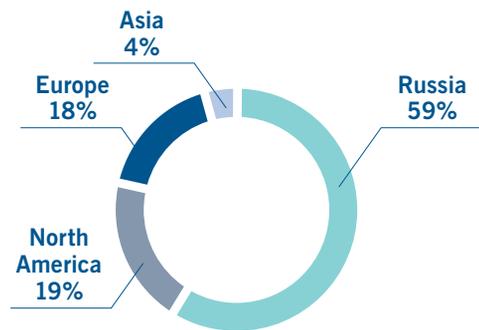
Almost 50 students from Massachusetts Institute of Technology, Technische Universität

München, University of Toronto, Danmarks Tekniske Universitet, University of York, Higher School of Economics, Moscow Institute of Physics and Technology and other universities participated in Skoltech **visiting program**. In most cases, the students were engaged in research projects under faculty supervision.

International students by citizenship



Geography of visiting students



Visiting students by university:

Russia: Higher School of Economics, New Economic School, Moscow Institute of Physics and Technology, Russian Presidential Academy of National Economy and Public Administration

North America: Massachusetts Institute of Technology, University of Toronto

Europe: Technische Universität München, Universiteit Hasselt, Imperial College London, Danmarks Tekniske Universitet, Ruhr-Universität Bochum, ISAE-SUPAERO Institut Supérieur d`Aeronautique, Universidad de Alicante, University of York, Università di Pisa

Asia: University of Electro-Communications, Sharif University of Technology

In support of maintaining Skoltech international study environment, a new initiative – **Global Campus** – was launched. It will offer students from the USA and Europe hands-on experience in fields of their interests through internships at Skoltech labs, Russian classes, and a cultural program. The first participants of the program were hosted by the CDISE.

Provisional agreements with Stanford, Brigham Young University, the State University of New York, and the University North Carolina Asheville were reached for hosting students in summer 2019.

The **recruitment campaign** for degree programs targeted to attract talented, ambitious students from Russia and abroad, maintaining a multi-cultural English-speaking environment.



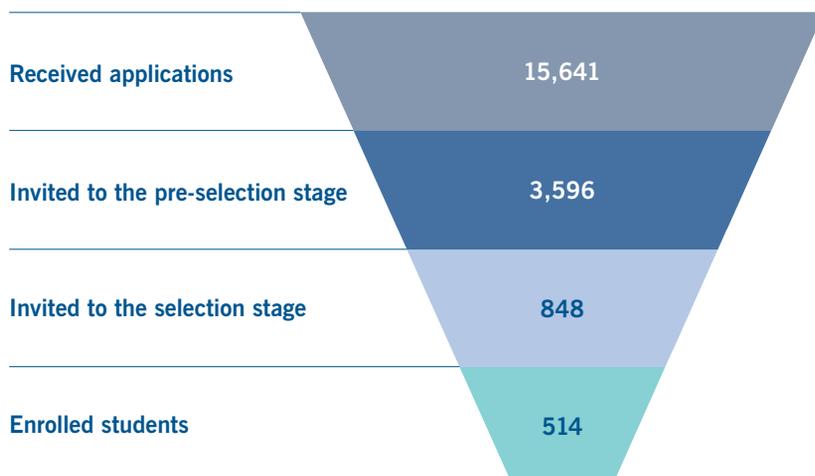
The campaign included outreach, application, selection and enrollment activities supported by Skoltech faculty and facilitated by the Student Department. Outreach combined “target opportunities,” events held at Skoltech and select universities and cities, and a “broad-brush” approach.

To ensure a broad coverage of prospective students, targeted media projects were developed jointly with Russian portals such as postnauka.ru, vc.ru, meduza.ru, and nplus1.ru. The highlight of the year – «Это точно» (That’s True), a comic book with 13 picture stories inspired by real research.

The recruitment channels were extended with Olympiad held jointly with the Higher School

of Economics. The format was successful: 9 winners were enrolled to the Statistical Learning Theory track of the MSc Data Science program (total track intake – 17 students).

More than 15 000 candidates registered in Skoltech admission system, which is 40% higher compared to the previous year. About 70% of MSc and 80% of PhD applications came from 135 countries. The selection process included an online test and review of academic records followed by the “Innovation Challenge” organized by the Center of Entrepreneurship & Innovation. In total, 848 applicants were invited to faculty panel interviews, of whom 514 accepted offers and became Skoltech students.



The **intake 2018** is represented by 356 MSc and 158 PhD students from 126 universities in 32 countries. 20% of newcomers are international students from 38 countries.

Regarding academic background, 75% are graduates of the top-300 universities⁴ and top-10 Russian universities; the rest are talents from all over the world.

MSc PROGRAM	2017 INTAKE	2018 INTAKE
Data Science	77	116
Information Science and Technology	14	25
Life Sciences	48	44
Advanced Manufacturing Technology	10	24
Petroleum Engineering	17	27
Space and Engineering Systems	24	34
Energy Systems	12	19
Materials Science	19	25
Photonics and Quantum Materials	22	31
Mathematical and Theoretical Physics	12	11
Total	255	356

PhD PROGRAM	2017 INTAKE	2018 INTAKE
Computational and Data Science and Engineering	32	41
Life Sciences	16	20
Petroleum Engineering	7	26
Materials Science and Engineering	20	23
Engineering Systems	22	21
Physics	12	13
Mathematics and Mechanics	8	14
Total	117	158

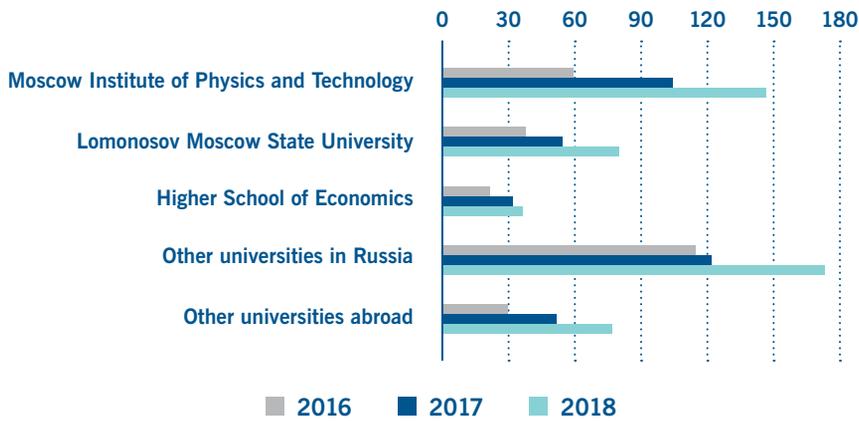


ALEXANDER SAFONOV, *Vice President for Development:*

“We widen opportunities for students and enrich experience at Skoltech by double degree and academic mobility programs. For example, for the second year in a row we organize Olympiad in collaboration with HSE, so that winners are enrolled in both universities, shape their study path from variety of courses, work on thesis under co-supervision. It enables faculty-to-faculty collaboration, and help shaping professional community.”

⁴ World University Rankings by Times Higher Education and Quacquarelli Symonds.

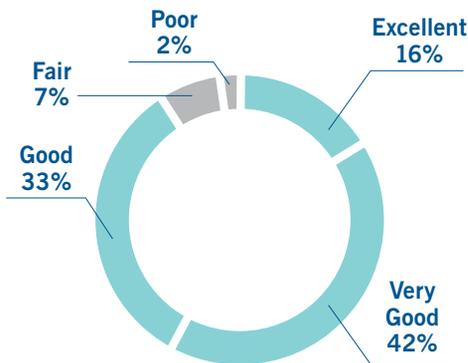
Intake academic background



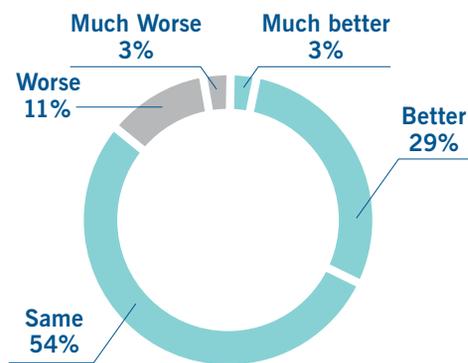
As the primary tool to measure recruitment campaign efficiency, a survey among faculty teaching classes during Fall 2018⁵ was conducted. The majority of

professors rated quality and performance of MSc intake positively. In comparison to 2017, 32% of faculty rated the intake “much better” and “better”.

“How would you rate the level of MSc intake enrolled in your course?”



“How would you rate MSc intake in comparison with intake of 2017?”



Skoltech students are highly motivated to forge their unique pathways to success, many of their hardworking endeavors turned into visible results. To name a few:

- **Dmitry Ulyanov** (supervisor Prof. Victor Lempitsky) received breakthrough results in the area of deep learning and presented them at the IEEE Conference on Computer Vision and Pattern Recognition, these have already been cited 93 times.

Ulyanov, D., Vedaldi, A., & Lempitsky, V. (2018). Deep image prior. Proc. of CVPR (pp. 9446-9454).

- MSc team of **Georgy Peshkov, Iskander Ibragimiov** (supervisor Prof. Artem Myasnikov), **Anna Gubanova, Dmitry Tikhomirov** (supervisor Prof. Dmitry Koroteev) won 1st prize in Aramco Upstream Solutions Technathon organized by the R&D Department of Saudi Aramco oil company. Valentina Ekimova (supervisor Prof. Evgeny Chuvilin) became a winner in the national science competition in the area of Arctic research.
- **Anna Maikova** (supervisor Prof. Konstantin Severinov) is the first author of the paper

⁵ 67% response rate.

in the area of CRISPR in Nucleic Acids Research (Impact Factor 10.162).

Maikova, A.*, J. Peltier, P. Boudry, E. Hajnsdorf, N. Kint, M. Monot, I. Poquet, I. Martin-Verstraete, B. Dupuy and O. Soutourina (2018). "Discovery of new type I toxin-antitoxin systems adjacent to CRISPR arrays in *Clostridium difficile*." Nucleic Acids Res 46(9): 4733-4751.

- **Ivan Tereshchenko** (supervisor Prof. Artem Abakumov) is the first-author of a paper in the area of metal-ion batteries in the Journal of the American Chemical Society (Impact Factor 14.357).

Tereshchenko, I. V.; I. V.; Aksyonov, D. A.; Drozhzhin, O. A.; Presniakov, I. A.; Sobolev, A. V.; Zhugayevych, A.; Stevenson, K. J.; Antipov, E. V.; Abakumov, A. M. "The Role of Semi-labile Oxygen Atoms for Intercalation Chemistry of the Metal-ion Battery Polyanion Cathodes," J. Amer. Chem. Soc. 2018, 140(11), 3994-4003

- Tekhnologii kardiolog⁶ startup set up by **Natalia Glazkova's** (supervisor Prof.

Tatyana Podladchikova) received a prestigious award at the Sevan Startup Summit in Armenia.

- Robotics reSET team led by Prof. Dzmitry Tsetserukou (**Nikita Veliev, Evgeny Safronov, Taras Melnik, Yakov Vasiliev, Mikhail Kurenkov, Andrey Chemikhin, Sergey Vostrikov, Victor Livinyuk**) became champions of Eurobot Open Russia 2018 competing with 22 teams from top Russian universities and companies and finished fifth at the Eurobot Final in France.
- **Roman Gonin** (supervisor Prof. Mikhail Bershtein) became a winner of the "Young Russia Mathematics" prize for PhD students.
- **Ilya Fradkin** (supervisor Prof. Nikolay Gippius) and **Alexey Lunkin** (supervisor Prof. Mikhail Skvortsov) became "Unique professionals" at the Yandex Olympiad "I'm a professional".



Skoltech robotics team reSET won first place in the Russian round of the international Eurobot competition (April 2018)

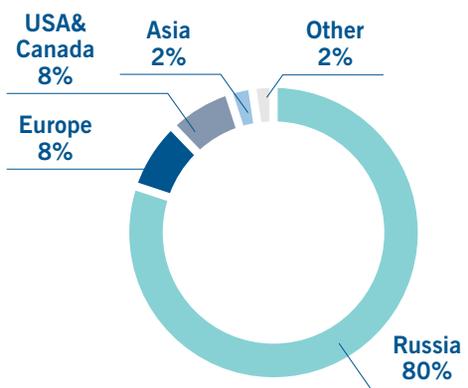
⁶ Sense2Beat – a heart monitoring biosensor with clinical-grade accuracy.

The Skoltech Student Council⁷ supported students on a wide variety of issues aiming at enriching experience. It organized freshmen orientation and community building events, facilitated student clubs covering different interests, including sports, startups, culture, and languages.

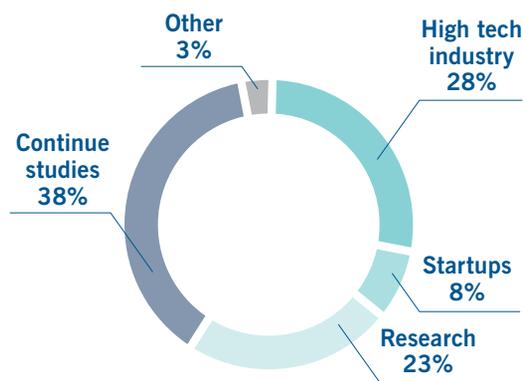
In 2018, 176 students became **graduates**. In terms of career paths, 59% were employed

within three months after graduation at Sberbank, Total, Yandex, Huawei Russia, Skoltech enterprises and other companies. 38% continue studies at Skoltech as well as other top international universities, including Carnegie Mellon, Princeton, Harvard Business School, University of Calgary, Technische Universität München, and Hong Kong University of Science and Technology.

Geography of Class 2018



Career paths of Class 2018



Abroad:

Harvard Business School (#3⁸), ETH Zürich (#7), Princeton University (#13), Toronto University (#28), University of Manchester (#29), McGill University (#33), Hong Kong University of Science and Technology (#37), Carnegie Mellon University (#46), Technische Universität München (#62), Tohoku University (#77), University of Calgary (#229)

Companies, startups, academia:

Sberbank, Total, Yandex, Huawei Technologies, Megafon, Ozon.ru, Samsung, CISCO, Rakuten, Tyler (startup), Lexy (startup), Blokhin Cancer Research Center, Kurchatov Institute, Novosibirsk State University, Moscow Institute of Physics and Technology, Russian Academy of Sciences, Russian Quantum Center, + 20 more companies

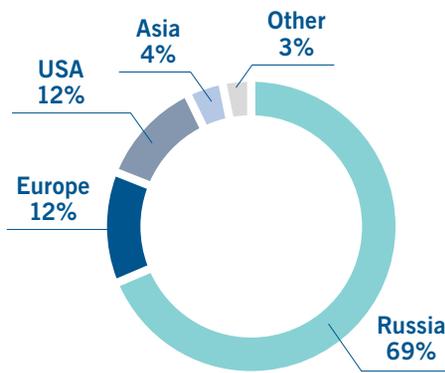
⁷ Self-governance body representing students' interests. The membership composed of students representing MSc and PhD programs, double degree programs, and foreign students.

⁸ All university rankings are provided in accordance with QS ranking 2019.

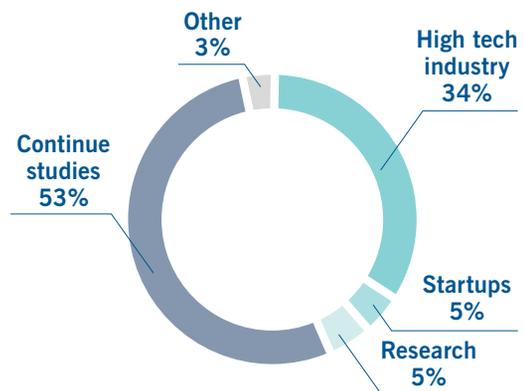
In 2018, Skoltech had a network of 400 alumni spread over 26 countries. With the goal of supporting the alumni community, a number of events were held (e.g. business-breakfasts, meeting with 2nd year MSc students on sharing experience for career development). During the campus inauguration, a milestone was a 1 million Rub donation from the

founders of Karfidov Lab to the Skoltech Endowment Fund. “We came to Skoltech in 2012 dreaming of establishing an engineering company,” said Karfidov Lab co-founder, Dmitry Vasilyev. “Our dream came true, so we would like to thank our professors and supervisors and everyone else who was there for us for their support.”

Geography of Classes 2015 – 2017



Career paths of Classes 2015 – 2017



Survey data as of Feb, 2019 (response rate 86%).

Abroad:

MIT (#1), Caltech (#4), EPFL (#22), Carnegie Mellon (#46), Aalborg University, Denmark (#343), KPMG, CISCO, Astro Digital Inc and others

Companies, startups, academia:

Samsung AI Center Moscow, Gazpromneft, Avito, Gazsurf, Huawei, Megafon, Sberbank, Sbertech, Sputnix, Yandex, Visionlabs, Karfidov Lab, TSNIIMASH + 20 more companies



EKATERINA MALYSHEVA, *President of Student Council:*

“Skoltech is a growing university that offers a variety of activities to support a rapidly increasing student body. During this year, we have established eight new student clubs. Skoltech also expanded its presence in the broader student community by taking part in inter-university team sports competitions. ”

// SUCCESS STORY

DMITRY VASILYEV

Skoltech graduate (2015), Karfidov Lab co-founder and Director for Development



I entered Skoltech in 2012, dreaming of a technology entrepreneur career. In the two years I spent here, I received an excellent education and founded an engineering company.

By the time I joined Skoltech, I had gone through all the standard educational milestones and was ready for greater achievements, so I eagerly immersed myself in an atmosphere of enthusiasm, creation and accomplishment. Skoltech fully met my expectations I felt that I belonged here and greatly enjoyed working in this inspiring environment.

We had a stellar first class of graduates, where everyone not only excelled in science but was highly motivated and geared for success. It is thanks to this stimulating environment that my skills gained at MISiS evolved into commercial undertakings. After I completed my studies at MIT and my first year at Skoltech, I realized that the small

design bureau we had had at MISiS could be transformed into a company. In 2014, I partnered with Alexey (Alexey Karfidov, co-founder and general designer of Karfidov Lab – Ed.) to establish Karfidov Lab.

With the knowledge and skillset I acquired at Skoltech, I created an engineering company from scratch. At the time, I was only 23 and still lacked experience, but I felt strongly encouraged by Skoltech professors and staff who were always there to offer their guidance and support. As of today, we have created 35 high quality-jobs, and the company's revenue is approaching 100 million. My dream came true, and I felt I ought to thank Skoltech for this, so at the inauguration of Skoltech's new campus on September 1, 2018, Karfidov Lab's team made a donation to Skoltech's Endowment Fund to contribute to the development of quality education.

// SUCCESS STORY

MARIA SOKOLOVA

Skoltech graduate (2018), Assistant Professor, Skoltech Center for Life Sciences



It was almost by accident that I found myself at Skoltech a few years ago, when I was still working at Konstantin Severinov's lab at the St. Petersburg Polytechnic University. I followed his advice and enrolled in Skoltech's PhD program, while having a vague idea about the academic career and post-PhD opportunities. Soon after, I realized that science is something I deeply enjoy and cannot do without.

At Skoltech, I encountered a style of learning totally different from what you'll find in other Russian universities. I attended the Pedagogy Course by Magnus Gustafsson (professor at Chalmers University of Technology, Sweden – Ed.) which was a valuable educational experience, both from the teaching and learning points of view. Thanks to Skoltech's academic mobility

program, I wrote a scientific work, attended major international conferences that helped to build strong ties with fellow scientists in my field that are indispensable for academic life, and visited multiple institutes and labs, taking note of the best practices that I will try to implement in my future lab.

Last June, I defended my PhD thesis, which was marked as "exemplary, stellar, and hard to match." In August 2018, I organized a summer school dedicated to the search and study of antibiotic-producing bacteria. Currently, I am preparing applications for several research grants and working with my MSc students to ensure that they produce good dissertations. Last but not least, I am blazing new trails while following the research path I chose for my PhD studies.

// SUCCESS STORY

NIKITA RODICHENKO*Skoltech graduate (2015), Tsuru Robotics founder and CTO*

Coming back to Russia after completing a one-year program at MIT, we (Anastasia Uryasheva, founder and CEO of Tsuru Robotics, and myself) realized that we wanted to work on a technology that had not yet developed strongly in Russia. At that time, it was drones, which later gave way to microelectronics and highly integrated systems. Currently, we are a full-stack robotics R&D company with a focus on product development.

My Skoltech MSc has had a strong influence on my career. I spent lots of time broadening my knowledge, making procurement decisions, taking care of equipment, on maintenance, and trying to help others with their tasks. In the meantime, I mastered rapid prototyping, which later proved to be an invaluable skill in real projects. Alessandro Golkar's course on Systems Architecture had a profound effect on my professional development, helping me gain major hard skills, such as the ability to develop, think through and evaluate the architecture of a complex system. Paired

with the ability to get things done, systems architecture became a major discipline in Tsuru Robotics, which I oversee personally as the CTO.

I have never actually thought of creating a business as an end goal, but rather as a way to bring my ideas to fruition and stick to my chosen path, working with a team of highly skilled professionals. This became possible not least because of Skoltech's commitment to encourage and support entrepreneurship. It allowed me forego fear and anxiety of early business development and focus on the things that mattered.

Over the four years since its foundation, our company has gained a firm foothold in the robotics development market. Last year, a large portion of our projects were international, with customers from Australia, Taiwan, Italy, and Ukraine. Since its foundation in 2015, Tsuru Robotics' turnover has tripled every year, and the team keeps growing, too. We are continuing to expand and address new ambitious goals.

Institutional Development

KEY PERFORMANCE INDICATORS

The KPIs system measures the institute's output against the goals of the Strategic Action Plan, approved by the Board of Trustees based on proposals of the Senior Leadership and CREI Directors. The table below indicates results of 2018 as well

as provides a three-year snapshot of the institute's development. In 2018, the institute fulfilled most targets, exceeding some. A minor decrease in the number of graduates is due to several defenses being postponed to 2019.

KEY PERFORMANCE INDICATOR	UNITS	2015	2016	2017	2018 TARGET	2018 ACTUAL
Human Capital						
Faculty	Persons	60	86	104	120	129
Postdocs & Researchers	Persons	74	112	184	215	229
MSc & PhD Students	Persons	315	481	706	810	977
Academic Excellence						
Publications in WoS, Scopus	Units / faculty	2.5	4.4	5.6	4.6	5.8
Graduates	Persons	51	81	92	180	176
Graduates involved in innovation activities	%	51	67	67	65	69
Value Generation						
Attracted funding	mln. Rub	265	348	554.7	1064	1113
Patent applications	Units / faculty	NA	NA	0.2	0.2	0.5
Skolkovo enterprises	Units	9	12	19	25	26
Other						
External funding	%	15	15	20	25	25

Annotation

Faculty	faculty having (i) long-term (one year or longer) employment agreements with at least 20% working time or (ii) candidates for faculty positions signed offers for employment under such terms. The indicator is calculated as of the end of the calendar year
Postdocs & researchers	research personnel with employment agreements as of the end of calendar year
MSc & PhD students	total number of MSc and PhD students as of the end of calendar year
Publications indexed in WoS, Scopus	ratio of faculty publications affiliated with Skoltech, indexed in Web of Science and/or Scopus, to the average number of faculty
Graduates	total number of MSc and PhD graduates during the reporting year
Graduates involved in innovation activities	ratio of MSc and PhD graduates (i) employed in industrial or research organizations in Russia, (ii) established new enterprises or employed in Skolkovo resident companies, (iii) doing internships in the specified organizations & companies; or (iv) continue PhD studies at Skoltech (refer to MSc graduates) to the total number of MSc and PhD graduates during the reporting period; this indicator is calculated based on alumni survey
Attracted funding	funding contracted within grants, R&D contracts, subsidies, service agreements (shared facilities, advisory services, professional training), technology licensing (royalty and IP sales), donations to Skoltech endowment
Skolkovo enterprises (cumulative)	Enterprises, established by Skoltech faculty, researchers, students or alumni, with a status of Skolkovo residents
Patent applications	total number of patent applications submitted by academic personnel to the average number of faculty
External funding, %	income from external ⁹ sources (grants, R&D contracts, professional training, services provided by Shared Facilities, income from licensing agreements, etc.) to the total of the institute's expenses (excluding capital expenditures for campus construction) during the reporting year

⁹ Excluding funding under the Skolkovo Foundation grant.

INSTITUTIONAL GOVERNANCE

Skoltech's governance system is presented by the Assembly of Founders, the Board of Trustees, the Academic Council and the President.

The Assembly of Founders is the highest collegial governing body that approves the charter, appoints the Board of Trustees, the Academic Council and the President, as well as making decisions on Skoltech membership in associations and legal entities. In 2018, the Founders approved amendments to the charter, Skoltech membership in technology

associations¹⁰, establishment of "Digital Petroleum" LLC¹¹ and participation in share capital of "SmartCom"¹² LLC.

The Board of Trustees conducts general oversight of the institute's activities. It approves the Strategic Action Plan, the Financial Plan, related reporting, and reviews proposals on major structural changes (e.g. launch or reorganization of CREIs). The Board supports the Founders with recommendations on Academic Council membership and the President's candidacy.

BOARD OF TRUSTEES



Chairman
Arkady Dvorkovich
Chair of the Skolkovo Foundation, Chairman of the Board of Trustees



Victor Vekselberg
President of the Skolkovo Foundation, Chairman of the Board of Trustees Executive Committee



Alexander Abramov
Chairman of the Board of Directors, Evraz Group



Alexander Kuleshov
Skoltech President



Tony F. Chan
President, King Abdullah University of Science and Technology



Richard Lester
Associate Provost, Massachusetts Institute of Technology



Edward Crawley
Ford Professor of Engineering, MIT Skoltech Founding President



Alexander Povalko
CEO of Russian Venture Capital



Alexander Galitsky
Co-Founder and Managing Partner, Almaz Capital



Alexey Repik
Chairman of the Board, "R-Pharm" JSC



Andrey Ivanov
Deputy Finance Minister of the Russian Federation



Chris Skirrow
Chairman of the Board of Trustees Audit Committee, former partner at PwC



Natalia Kasperskaya
President, InfoWatch, Founder of Kaspersky Lab



Stanislav Smirnov
Professor, University of Geneva Skoltech Founding faculty



Oleg Kharkhordin
Rector, European University in Saint-Petersburg



Vladislav Surkov
Aide to the President of the Russian Federation



Valery Katkalo
Rector, Sberbank Corporate University



Paul Thompson
Director, ENIGMA Consortium for Worldwide Medicine



Nikolay Kudryavtsev
Rector, Moscow Institute of Physics and Technology

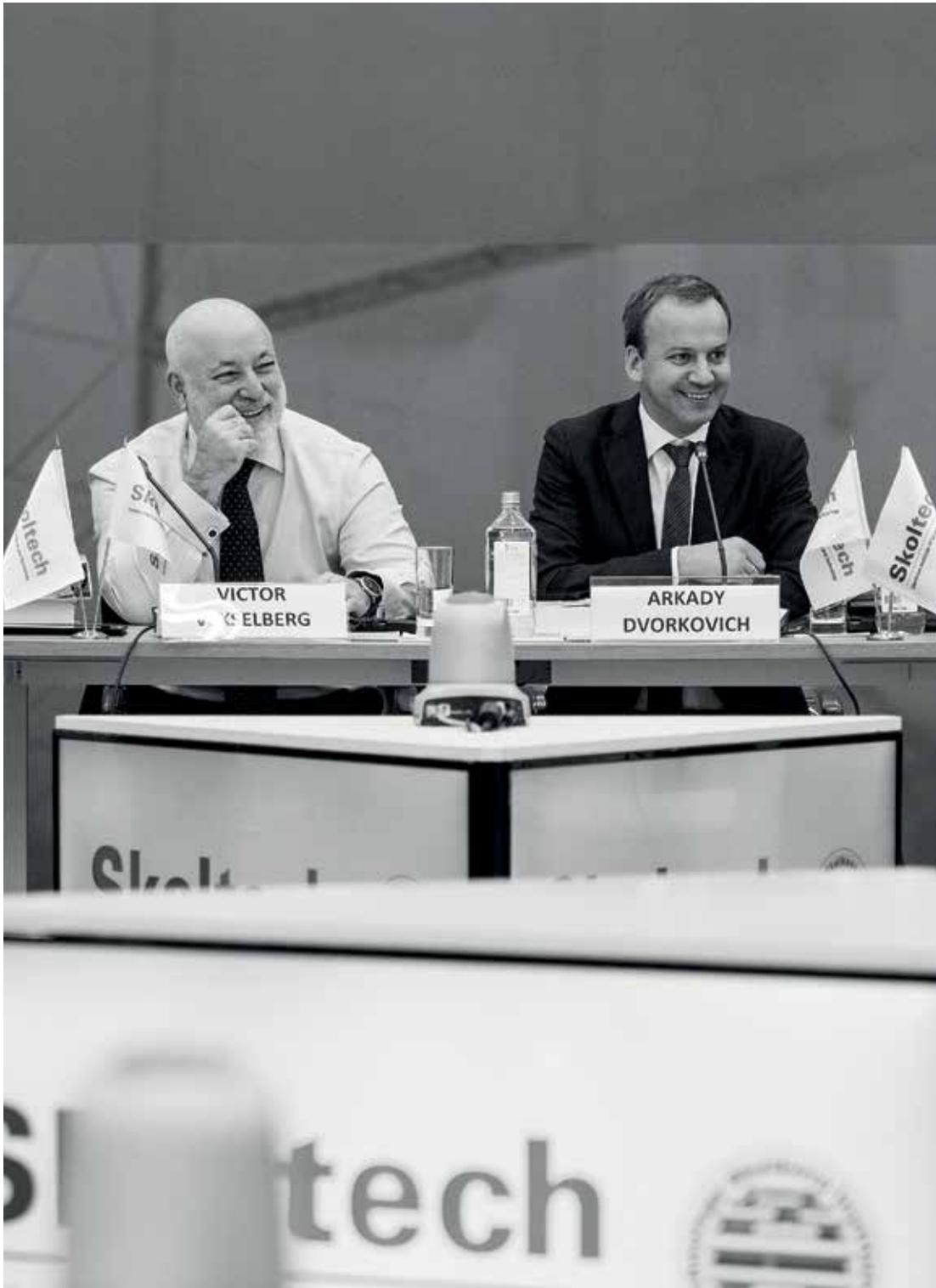


Pekka Viljakainen
Senior Advisor to the President of the Skolkovo Foundation

¹⁰ National Supercomputer Technology platform, Association of market participants Internet of Things, BioTech2030, Medicine of the Future.

¹¹ Spin-off of Skoltech Center for Hydrocarbon Recovery

¹² Enterprise (Skolkovo resident) established by the Skoltech Center for Data-Intensive Science & Engineering.



Chairman of the Skolkovo Foundation, Chairman of the Board of Trustees Arkady Dvorkovich and President of the Skolkovo Foundation, Chairman of the Board of Trustees Executive Committee Victor Vekselberg at the meeting of the Board of Trustees (December, 2018)

In 2018, the Board comprised 20 members – senior management of the Skolkovo Foundation, leading Russian and international universities, governmental bodies, institutes of development, and founders of private high tech companies.

In 2018, the Board approved the Annual Report 2017, structural changes in “Life Sciences & Health” and “Energy Efficiency” Target Domains, the Strategic Action Plan and Financial plan for 2019 – 2021. The Board supported the President’s proposal on rotating the Academic Council membership¹³. Among the other items reviewed – the CEI development concept, fundraising strategy, adjustments to the annual budget.

Within its structure, the Board of Trustees has the Executive Committee and the Audit Committee. In 2018, the Executive Committee conducted a preliminary review of the items that required approval of the Board (interim reports on KPIs, a proposal on the establishment the CNBR) while the Audit Committee reviewed issues related to the external audit process, control environment and risk management.

The Academic Council oversees the institute’s educational, scientific, R&D and innovation activities. In 2018, the Council comprised 18 members – Skoltech faculty and senior management, and external members.

ACADEMIC COUNCIL



**Chairman
Prof. Alexander
Kuleshov**
*Skoltech
President
(ex-officio)*



**Prof. Clement
Fortin**
*Interim
Provost, Dean
of Faculty*



**Deputy Chairman
Prof. Rupert
Gerzer**
*Advisor to
Skoltech
President*



**Prof. Ildar
Gabitov**
CPQM



**Academic
Secretary
Dr. Alexander
Safonov**, *Vice
President for
Development*



**Prof. Grigoriy
Kabatiansky**
*Advisor to
Skoltech
President for
Science*



**Prof. Iskander
Akhatov**
*Director,
CDMM*



**Prof. Nikolay
Kudryavtsev**
*Rector, Moscow
Institute of
Physics and
Technology*



**Dr. Jean
Botti**
*CEO,
VoltAero
SAS*



**Prof. Artem
Oganov**
CEST



**Prof. Alexey
Buchachenko**
CEST



**Prof. Andrei
Okounkov**
CAS



**Prof. Edward
Crawley**
*Ford Professor
of Engineering,
MIT. Skoltech
Founding
President*



**Prof. Pavel
Pevzner**
*University
of California,
San Diego*



**Dr. Alexander
Fertman**
*Director on
Science and
Education,
Skolkovo
Foundation*



**Prof. Valery
Rubakov**
*Moscow State
University,
Russian
Academy of
Sciences*



**Prof. Boris
Fine**
CPQM



**Prof. Keith
Stevenson**
*CEST, Dean
of Research*

During the year, the Council reviewed the Strategic Action Plan, focusing on the CREIs plans and the plans of new units – the Mass Spectrometry Laboratory (CDISE), the Cyber-Physical Systems Laboratory (CDMM), the

Hybrid Photonics Laboratory (CPQM), and the Shared Facilities (Genomics, Advanced Imaging, FabLab and Machine Shop, a Micro- and Nanofabrication Cleanroom, Bioimaging and Spectroscopy).

¹³ Rotation of the Academic Council membership is planned due to expiry of the term of office (3 years).

On the procedural side, the Council revised its Regulations to ensure a stronger role in overseeing R&D and innovation activities, determined principles for rotating

membership based on which the Centers nominated faculty¹⁴. The Committees were fully operational, supporting the institute with a review and decisions on main activities.

COMMITTEE	MEETINGS	MAIN ACTIVITIES
Appointment, Promotion & Tenure Committee	9 regular 1 absentee	<ul style="list-style-type: none"> 98 reviewed cases of hiring, promotion and contract renewal 56 positive resolutions taken
Education Committee	7 regular 5 absentee	<ul style="list-style-type: none"> approval of educational programs portfolio approval of the academic calendar approval of PhD Defense Policy review the proposal on Professional Training Programs Policy nomination of Final Attestation Committees Chairs setting principals for partnership programs
Research & Innovation Committee	5 regular 6 absentee	<ul style="list-style-type: none"> setting procedure to review research equipment requests screening and recommendations on purchase equipment requests approval of scope of work and reports on MRAs

The Strategic Action Plan (SAP) defines the institute's priorities for development, key tasks and activities, and KPIs. The SAP is updated annually to adjust targets and the scope of tasks considering interim results. The update

for 2019 – 2021 kept the goals set earlier, implying adjustment of the KPIs system to emerging opportunities and challenges, CREIs development planning, revision of tasks performed by the Functional Blocks.

INSTITUTIONAL KPIs	UNITS	2019	2020	2021
Academic Excellence				
Publications indexed in WoS, Scopus	No./faculty	4.1	4.2	4.3
Graduates	Persons	240	360	360
Graduates involved in innovation activities	%	70	70	70
Value Generation				
Attracted funding	mIn. Rub	1250	1370	1500
Patents applications	No./faculty	0.3	0.5	0.6
Skolkovo residents enterprises (cum.)	Units	40	55	70
Other				
External financing, % to the total of Institute's expenses	%	25	26	27

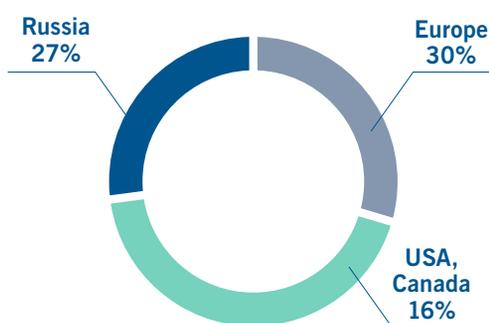
¹⁴ The new composition of the Academic Council was pre-approved by the Board of Trustees (Dec, 2018) and will be submitted for approval of the Founders in Q1, 2019.

The planning process of the CREIs took a few months and included self-assessment, a review conducted by external advisory groups, elaboration of development plans to assure focus and alignment with the institute's vision of being among the world's leading academic institution.

The advisory groups were formed

considering nominations of CREI Directors, the Academic Council, members of the Skolkovo Foundation and Trustees. In total, 37 experts, representing international and Russian universities, academic institutions, national labs, high-tech companies, and innovation centers, supported the CREIs in a planning process.

Geography of experts



Affiliations:

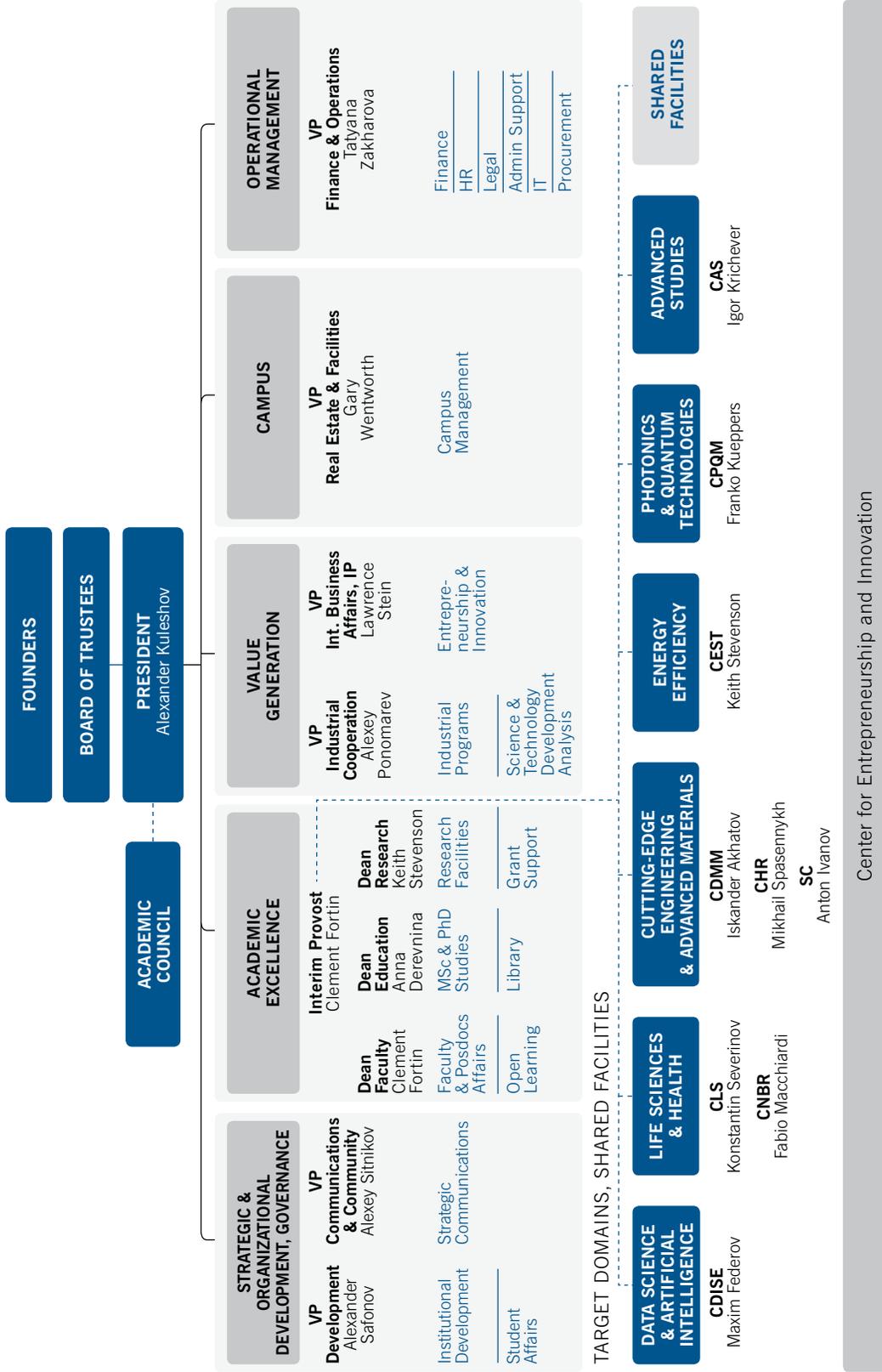
Europe: Cambridge University, ETH Zurich, University of Duisburg-Essen, Institute of Science and Technology Austria.

USA, Canada: MIT, University of Pennsylvania, Boston University, University of Colorado Boulder, Rutgers University, Calgary University, Stony Brook, Georgia State University, New Mexico State University, Roswell Park Comprehensive Cancer Center.

Russia: Bosch R&D Center Higher School of Economics (Russia), National Research Center for Hematology, Novosibirsk State University, Institute of Solid State Physics, RAS, R&D Center EMC, DeGolyer and MacNaughton.

The institute's organizational structure is set in five functional blocks, to support the SAP execution. The chart presents management structure, key functions and lines of responsibilities.

SKOLKOVO INSTITUTE OF SCIENCE AND TECHNOLOGY MANAGEMENT STRUCTURE



In 2018, a few organizational changes were made.

- Establishment of the **Center of Life Sciences**¹⁵ (Life Sciences & Health Target Domain) led by Prof. Konstantin Severinov. The Center will focus on bioinformatics/ data-intensive biology, bioactive/bio-derived products, agro, and biomed.
 - Establishment of the **Center for Neurobiology and Brain Restoration** (Life Sciences & Health Target Domain) led by Prof. Fabio Macciardi. The Center will focus on human cognitive mechanisms and new tools and techniques for restoration, maintenance, and optimization of brain functions.
 - Establishment of the **Center for Energy Science and Technology**¹⁶ (Energy Efficiency Target Domain) led by Prof. Keith Stevenson. The Center will conduct research in areas of electrochemical energy storage and conversion, solar energy conversion and storage, smart energy grids, energy markets and regulation, and computational energy materials.
 - Appointment of **Prof. Franko Kueppers** as Director of the CPQM (Photonics and Quantum Technologies Target Domain). The Center will continue fundamental and applied research in the area of photonics and quantum materials.
 - Establishment of the **Mass Spectrometry Laboratory** (CDISE) under the guidance of Prof. Evgeny Nikolaev. The Lab will focus on biomedical mass spectrometry and omics technologies, analytical mass spectrometry and petroleomics, and mass spectrometry for space research.
 - Establishment of the **Laboratory of Cyber-Physical Systems** (CDMM) under the guidance of Prof. Ighor Uzhinsky. The Lab will develop and introduce into the manufacturing sector a set of methodologies facilitating efficient utilization of developed and prospective design and engineering software and hardware systems.
 - Establishment of the **Laboratory for Modeling of Multiphase Systems** (CHR) in partnership with Gazprom Neft. The Lab, led by Prof. Andrey Osiptsov, will develop advanced models of multiphase systems for the design of new oilfield service technologies.
 - Establishment of the **Hybrid Photonics Laboratory** (CPQM), led by Prof. Pavlos Lagoudakis. The Lab will develop experimental and theoretical tools to devise and test an in-house analogue simulator utilizing polariton graphs.
 - Establishment of the **Center of Excellence “Wireless Communication Technologies and Internet of Things”**¹⁷ (CDISE), led by Prof. Dmitri Lakontsev. In consortium with universities and high-tech companies, the Center will provide support and expertise to Russian companies for development and application of technologies, usage of products and services in the fields of Wireless Technologies and Internet of Things.
 - Establishment of the **Center of Competencies “Co-Brain Analytics”** (CDISE), which will hold activities within the National Technology Initiative project on developing a system for processing large neural data to support the implementation of NeuroNet technologies.
 - Opening of the **Center for Open Learning** led by Tatyana Nikolenko. The Center will coordinate development and implementation of programs for gifted kids & the wider community, including projects for “Skolkovo” gymnasium, “Sirius” Educational Center, park “Zaryadie”, and “Kvantorium” Technopark.
- Following the SAP tasks, the Shared Facilities were established – the Genomics Core Facility, FabLab and Machine Shop, Advanced Imaging Core Facility, Micro- and Nanofabrication Cleanroom, Biolmaging and Spectroscopy Core Facility.
- A few administration units were set-up to support specific functions of the SAP:

¹⁵ Merging of the CDIBB & CTB.

¹⁶ Merging of CEE & CES.

¹⁷ National Technology Initiative project.

- The **Student Department** implements recruitment campaigns, leads activities for developing student community and career advice programs, provides support services, and engages with alumni.
- The **Monitoring & Report Office** facilitates institutional planning and reporting, and submits statistics required by the regulators.
- The **Analytical Department of Science & Technology Development** organizes and conducts analytical work and research in the field of science and technology policy for Russian governmental agencies, institutes of development, high-tech companies. It also monitors the global science and technology agenda.

Strategic Communications

The year marked a significant increase of Skoltech media coverage, the number of faculty interviews on federal television and radio, popular newspapers and magazines, as well as visits of Russian and international high-profile delegations.

The number of references to Skoltech exceeded 10,000 (6178 – in the federal media, 3193 – in the regional media, 600 – in the foreign media). About 9,000 references were marked in online media, among the rest – about 500 in news agencies reports and 600 in print media, TV, radio and blogs.

Compared to 2017, the number of VKontakte and Facebook subscribers increased by 5,000 and 2,000 respectively. Nevertheless, the ratio of audience involvement remained moderate, leaving room for further improvement. Skoltech website traffic amounted to 126 thousand people.

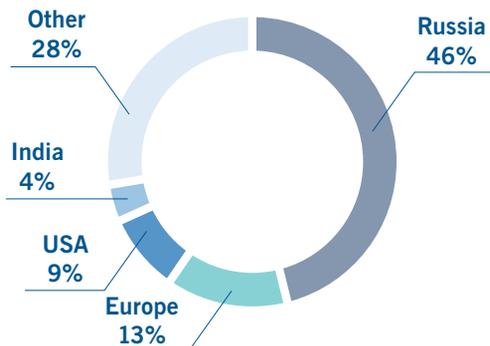
The most striking Skoltech scientific results became the topic of 38 popular science press releases prepared for a wide audience resulting in an increase of Skoltech media coverage.

Targeted media projects were launched based on original ideas adding traditional scientific communication formats. Among the highlights is “Физически это возможно” (Horizons of Physics) project in collaboration with Kommersant. Two materials were selected for “Ogonek” magazine cover page. The breakthrough of the year is the comic book “Это точно” (That’s True) awarded with the Diploma “For Dedication to Science” from the Russian Ministry for Science and Higher Education. The “Mathematical Walks” were awarded with the Diploma of Communication Lab of the Russian Venture Company (nomination “Experiment”), a contract with China’s publishing house “Rightol Media” for publishing the book was signed (pilot circulation of 5,000 copies in Chinese).

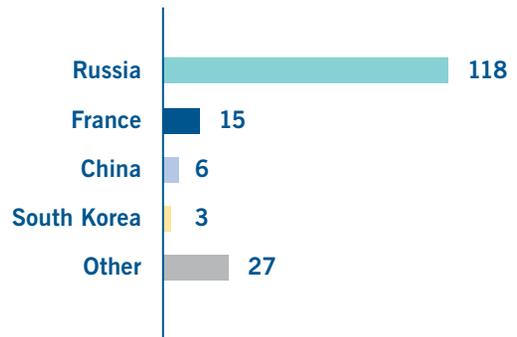
Skoltech in media presence



Visitors to Skoltech web page (2018)



Delegations by country (2018)



ALEXEI SITNIKOV, Vice President for Community Development and Communications:

“The year marked a significant increase of Skoltech media coverage, number of faculty interviews on federal television and radio, popular newspapers and magazines, as well as visits of Russian and international high-profile delegations.”



Skoltech hosted CDIO EUROPEAN REGIONAL MEETING 2018, focused on research- and innovation-based education. Edward Crawley, the Founding President of Skoltech, made an introductory statement (January 2018)



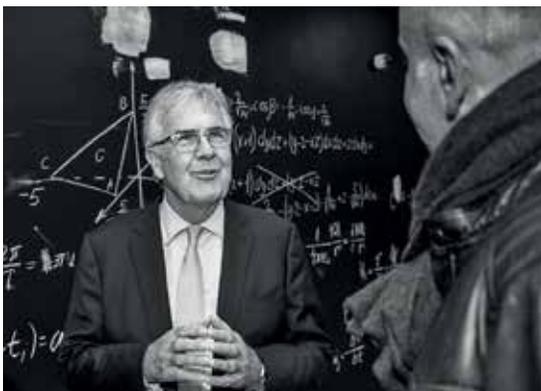
Director of NMRC PM Oksana Drapkina and Skoltech President Alexander Kuleshov pictured at the memorandum signing ceremony (March 2018)



European Research Council (ERC) President Jean-Pierre Bourguignon on a visit to Skoltech. From left: Stanislav Smirnov, Jean-Pierre Bourguignon and Alexander Kuleshov (May 2018)



German billionaire Stefan von Holtzbrinck, co-owner of Verlagsgruppe Holtzbrinck publishing company, pictured during his visit to Skoltech (September 2018)



Lord John Desmond Waverly, member of the House of Lords of the UK Parliament, pays a visit to Skoltech (October 2018)

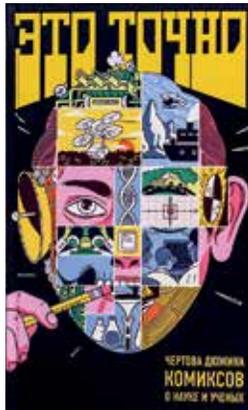


Heads of 50 diplomatic missions are welcomed at Skoltech (December 2018)

MEDIA PROJECTS



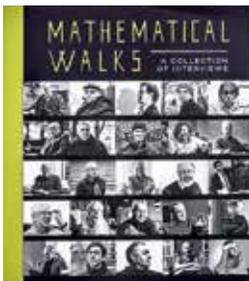
«Физически это возможно»
 (The Horizons of Physics)
 Kommersant /
 Ogonek magazine
 2000 views; longreads/
 interviews with Prof. Vladimir
 Zakharov, Prof. Ildar Gabitov
 and Prof. Valery Rubakov
 recognized as the best
 materials (Editor's choice)



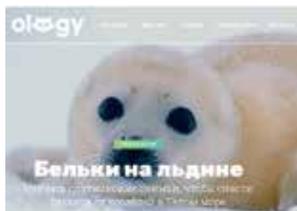
«Это точно!»
 (That's true)
 Comic book with 13
 stories featuring
 Skoltech faculty research,
 5000 copies sold out
 Eksmo Publishing House



«Цифророжденные»
 (Digital Natives)
 20,000 copies sold out



«Математические прогулки»
 (Mathematical walks)
 Publishing house
 "Paulsen" (Russia)
 Rightol Media" (PRC)
 Publication and book
 5000 copies for
 distribution in PRC



«Дежурный по планете»
 (Planet watch) Joint project
 with Sirius Educational
 Center, Roscosmos and
 the Innovation Promotion
 Foundation
 Online media OLOGY
 Test "Are you ready to save
 the seals in the White Sea?",
 2200 views
 Longread "Seals on the Ice"
 on Ology
 over 2000 views



«Дежурный по планете»
 (Planet watch)
 Online media N+1
 Video on N+1 "Selfie
 from orbit"
 2600 views

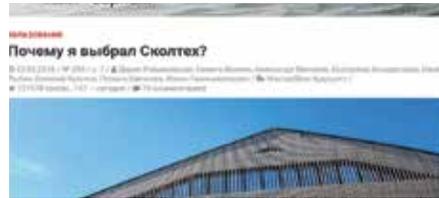


VALERIY RUBAKOV, *Member of Skoltech Academic Council:*

"Amazing things happen in physics all the time. This was true 50 years ago and is even more true today. The topics we are studying now will not only help us to improve our understanding of nature, but also bring about a great change for people."



**«Мастерская будущего»
(Workshop of the Future)**
Online science magazine PostNauka
Course covering 7 MSc Programs
(71 materials: Lectures by Skoltech professors, videos, interviews, tests, textbooks, thesauri)
903,030 Views (website, YouTube)



**«Мастерская будущего»
(Workshop of the Future)**
Newspaper «Troitsky Variant – Nauka»
6 Publications, 570,000 views



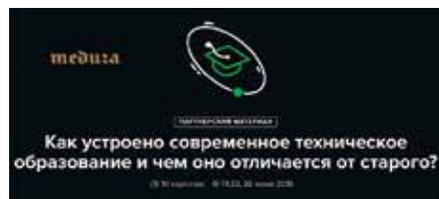
**«Мастерская будущего»
(Workshop of the Future)**
Online media N+1
2 tests (RU/EN)
on MSc program “Energy Systems”
Comic story



**«Мастерская будущего»
(Workshop of the Future)**
Online media N+1
2 tests (RU / EN) on MSc program
“Information Science and Technology”
Comic story



**«Пять научных дисциплин,
которые меняют бизнес»
(Five Scientific Disciplines that are
Changing Business)**
Online resource for new generation
entrepreneurs vc.ru
Multimedia longread
40,568 views



**«Как устроено современное
техническое образование и чем
оно отличается от старого?»
(How Modern Technical Education is
Arranged and how it Differs from the Old)**
Online media MEDUZA
10 cards
56,262 views



ILDAR GABITOV, Professor at Skoltech:

“Society should be aware of what scientists are doing and scientists should make their research findings known to the broader public. Popular science papers in Russian and foreign editions are the most efficient and accessible science education format.”

SERVING THE WIDER COMMUNITY

Skoltech is strongly devoted to active engagement with the wider community through a variety of events and programs designed at science popularization and educating gifted kids and students.

Since 2017, Skoltech and the Talent and Success Foundation are cooperating to organize lectures and provide overall support to project activities of the **Sirius Educational Center**¹⁸. In 2018, Skoltech activities included over 15 lectures given by eight professors, five multi-day educational programs, and expertise provided on setting select laboratories. Among the key projects:

- **Planet Watch** (supporting Skoltech Center – Space, Prof. Anton Ivanov) – a program to attract students to space exploration. The first stage includes five competitions, which will entail a series of educational and learning activities that will enable schoolchildren from all over the country to gain first-hand experience with select modern space technologies. The project is conducted in collaboration with Bortnik Foundation and ROSCOSMOS.
- Participation in **Big Challenges 2018** (supporting Skoltech Center – Life Sciences, Prof. Konstantin Severinov; Center for Entrepreneurship and Innovation, L. Stein.) – Involvement of kids in projects with real life tasks and objectives set by leading companies and research institutions. Three projects (Brain Regeneration, The Search for Universal Markers of Neural Activity, CRISPR-CAS Immunity) in the “Personalized and Prognostic Medicine” division were successfully carried out. Two CEI professors delivered open lectures concerning project management.

- **Turbo-Science 2018** (supporting Skoltech Center – Photonics and Quantum Materials, Prof. Boris Fine) – a distant 3-months tutoring program aimed at inspiring Sirius graduates to choose a field of study connected with modern science and technology. The program is being implemented for the second year.

In addition to comprehensive education at the **Skolkovo Gymnasium**, Skoltech (Supporting Skoltech Center – Center for Open Learning, T. Nikolenko) developed 12 science lab programs that allow students to improve their practical skills and scientific thinking in the area of molecular biology and engineering. The programs will be introduced to wider school networks as advanced educational practices. The Center also provided the Federal **Quantorium Technoparks** Network with scientific and technological expertise at the International Contest of Children Engineering Teams. Skoltech academic personnel refereed eight tracks of the final Quatorium Competition held in Saint-Petersburg.

Skoltech welcomed 150 students, scientists and engineers for a three days’ Neuro-Hackathon organized by the Centre of Excellence for Wireless Communication and the Internet of Things in collaboration with the Research Centre of Neurology and Philips. The prize fund was awarded to the NeuroteamZero, Syberia, Squirrels per ha, Garbage Creators, FaRaDenZa and Siny Git. The members of all winning teams got the opportunity to intern at the event’s partner-companies, and take part in the Skoltech accelerator. The **Quantum Computing** Hackathon was held by Deep Quantum Lab, CDISE, jointly with Moscow State University.

¹⁸ Established in 2015 in the southern Russian region of Sochi with a mission to identify and develop talented kids & students with a particular emphasis in the natural sciences, arts, sports and technical creativity.



Skoltech students and young scientists taking part in the project session at Sirius (July 2018)



Skoltech students and young scientists taking part in the project session at Sirius (July 2018)



Schoolkids honored for their personalized and practical healthcare research projects performed at the Sirius Educational Center with the support of Skoltech students (July 2018)



First-graders of the Skolkovo Gymnasium visiting the Enhanced Oil Recovery Laboratory (CHR) (April 2018)



First-graders of the Skolkovo Gymnasium visiting the Enhanced Oil Recovery Laboratory (CHR) (April 2018)



First-graders of the Skolkovo Gymnasium visiting the Enhanced Oil Recovery Laboratory (CHR) (April 2018)

Fourteen teams of undergraduate and graduate students specializing in Physics, Computer Science, Mathematics and Engineering participated in the event.

The Skoltech Lecture Hub opened at the brand-new Moscow **Zaryadye Park**. The first three lectures were delivered by the President, Prof. Alexander Kuleshov, on the long-term impacts of robotization and artificial intelligence, Prof. Philipp Khaitovich on evolution and development of the human brain, and Prof. Konstantin Severinov on bacterial immunity and genomic editing. Over 250 people attended the lectures and thousands more joined live broadcasting. Media coverage exceeded 30 items, while social network coverage exceeded hundreds of items.

For the third year in a row, Skoltech and the Independent University of Moscow organized the **Young Mathematics in Russia** call for talented young scholars pursuing research in mathematics and its applications. An international jury composed of leading scientists reviewed the applications and selected winners from St. Petersburg State University, Skoltech, the Higher School of Economics, Steklov Mathematical Institute, and the St. Petersburg Academic University of the Russian Academy of Sciences.

The **Undergraduate Summer School** in molecular biology was held by the CLS. The curriculum was developed by recent PhD graduate, Maria Sokolova, and is a unique combination of theoretical expertise balanced with practice. The school brought together

13 students from different parts of Russia, Belarus, Kazakhstan, and Uzbekistan. Apart from lectures and seminars, the participants gained research experience in the molecular biology teaching laboratory. The school was highly successful according to students' enthusiastic and excited responses. 'It was the best summer school in my life. It was great, interesting and fascinating! I have learned many useful molecular biology skills and listened to lectures by outstanding professors!' says one of the participants, Diana Koldasbaeva from Kazakhstan.

Under the guidance of Prof. Artem Oganov, a group of Skoltech scientists prepared and delivered an intense **Materials Science course** for gifted schoolchildren from across Russia. The course included lectures on topics outside the standard school curriculum – Computational Design of Materials, Chemical Communication Theory and Numerical Methods, and Scientific Programming.

The **3rd School of Young Scientists**, "Topical Issues of Modern Electrochemistry and Electrochemical Materials Science," was held by the CEST. The school encountered >70 students from Russia, Kazakhstan and Belgium. The lecturing team comprised prominent scientists from Japan, France, Belgium, USA, UK, Switzerland, Luxembourg and Russia.

A series of courses was delivered by the CDISE faculty and researchers during the "Ostrov 10-21" event; this was in the framework of the **University 2035** initiative in Vladivostok in summer 2018.



PAVEL TREHLEB, *Director of Zaryadye Park:*

"We are happy to help children in gaining knowledge, discovering new gifts, and developing creative abilities as well as a passion for science. Together with Skoltech, we will create new educational outreach programs to make the science learning process more fascinating and easy-to-follow, even for elementary school kids."



Skoltech President Alexander Kuleshov delivering an open lecture «Impacts of robotization and artificial intelligence on our future» in Zaryadye Park (November 2018)



Following Kuleshov's lecture, Professor Dmitry Tsetserukou of the Skoltech Space Robotics Lab tells the audience about the lab's latest research (November 2018)



The dataset for Neurohackaton's scientific track was put together using CoBrain-Analytics data (November 2018)



Russia's first Neurohackaton dedicated to multiple sclerosis took place at Skoltech (November 2018)



Professor Konstantin Severinov giving an open lecture "From bacterial immunity to genomic editing" in Zaryadye Park (December 2018)



Professor Philipp Khaitovich giving an open lecture "Human brain evolution" in Zaryadye Park (December 2018)

Academic & Technology Excellence

2022

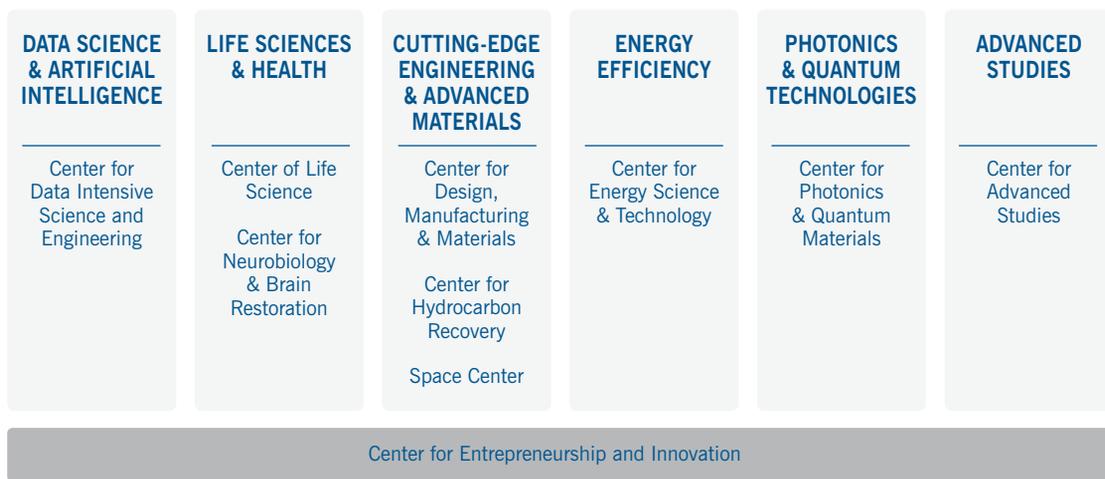


CLEMENT FORTIN, *Professor, Interim Provost, Dean of Faculty:*

“Academic and technology excellence are Skoltech raison d’être and great progress has been achieved since its foundation.”

Academic and technology excellence is Skoltech's raison d'être and great progress has been achieved since its foundation. The institute's framework for driving academic & technology excellence is built on the Target Domains – focus areas that address critical scientific,

technological and innovation challenges and gaps facing Russia and the world. The Centers for Research, Education and Innovation (CREIs), labs set in collaboration with industrial partners, and the Center for Entrepreneurship and Innovation (CEI) compose the framework.



The Centers for Research, Education and Innovation are the main integrators and drivers for implementing long-term programs for developing education, science, research and development, and

innovation potential of the institute. In pursuing academic and technology excellence, the Centers conduct cutting-edge basic and applied research in the areas of specialization.

CDISE	Artificial Intelligence, especially Machine Learning, Data Science, Deep Learning, Quantum Enhanced Computation & Internet of Things.
CLS	Bioinformatics/Data-Intensive Biology, Bioactive/Bio-derived Products, Agro-Science, and Biomed.
CNBR	Developmental Neurobiology, Molecular Neurobiology, Computational Neurobiology, and Brain Restorations.
CDMM	Materials, technologies, processes, digital engineering and management: Polymer-based Composite Materials, 3D-Printing Technologies, Thermal Spray Processes, Digital Design and Manufacturing, and Product Lifecycle Management.
CHR	Geomechanics, Enhanced Oil Recovery, Geophysics and Petro-Physics of Unconventional Reservoirs, Gas Hydrates and Permafrost, Advanced Reservoir Simulations and Data Science in Application to the Oil and Gas Industry.

SC	New approaches for system concepts, implementation and operating of complex systems through their lifecycle. Strategic thinking (technology design and management), Advanced Engineering (space hardware and robotic systems), Complex Systems Applications (commercial applications and scientific exploration).
CEST	Electrochemical Energy Storage, Electrochemical Energy Conversion, Solar Energy Conversion and Storage, Smart Energy Grids: Systems and Devices, Energy Markets and Regulation and a crosscutting thrust on Computational Materials.
CPQM	Quantum Materials (2D Materials, Superconductors, Semiconductors, Quantum-Coherent Systems). Photonics include basics of Light-Matter Interaction, Nano-Plasmonics, Metamaterials, Polariton Bose-Einstein Condensates, Physics of Optical Communications, and Biophotonics.
CAS	Areas of Geometric Representation Theory, String Theory, Conformal and Gauge Field Theory, Integrable Models, Combinatorics and Singularity Theory, Symplectic Geometry, Topology, Statistical Physics, Dynamical Systems, and Hyperbolic Geometry.

The Centers lead the development of the educational domain, e.g. conduct globally competitive programs, participate in student outreach and selection, and supervise research projects and theses. With regards to value generation, the CREIs contribute by establishing project teams and new enterprises, creating intellectual property, conducting industry-funded R&D projects, and advisory services.

In support of the strategic initiative to set industry-oriented labs, during the year Skoltech opened the **Joint Laboratory on Additive Manufacturing (CDMM)** with Oerlikon (Switzerland) and Technical University of Munich, and the **Joint Laboratory for Modeling of Multiphase Systems (CHR)** with Gazprom Neft JSC. An agreement on establishing the Skoltech & Huawei

Innovation Lab was signed; the Lab will focus on artificial intelligence including machine learning, neuron networks, computer vision, language processing, and recommendation systems. Agreements on setting up labs with **Samsung, TopCon Global Positioning and Russian Post** are in the pipeline.

The Center for Entrepreneurship and Innovation (CEI) is the institute's core element in fostering and linking the Centers' research and education with innovation and entrepreneurship. The CEI nurtures a unique Skoltech culture of innovation and entrepreneurship by developing specialized courses involving Skoltech personnel, students and alumni in establishing and developing new enterprises. The CEI manages the institute's IP and leads technology licensing.



ISKANDER AKHATOV, Professor, Director of Skoltech Center for Design, Manufacturing and Materials: "Successful collaboration projects, such as the Skoltech and Oerlikon joint Additive Manufacturing Lab, and commitment to attain the challenging research goals helps push the boundaries of international cooperation. Oerlikon and Skoltech will expand their strategic partnership to cover both the additive manufacturing and protective coating technologies."

Teaching & Learning

Skoltech delivers and continues the development of 10 MSc and 7 doctoral programs. Almost 1000 full-time students study at Skoltech: 594 MSc and 383 PhD.

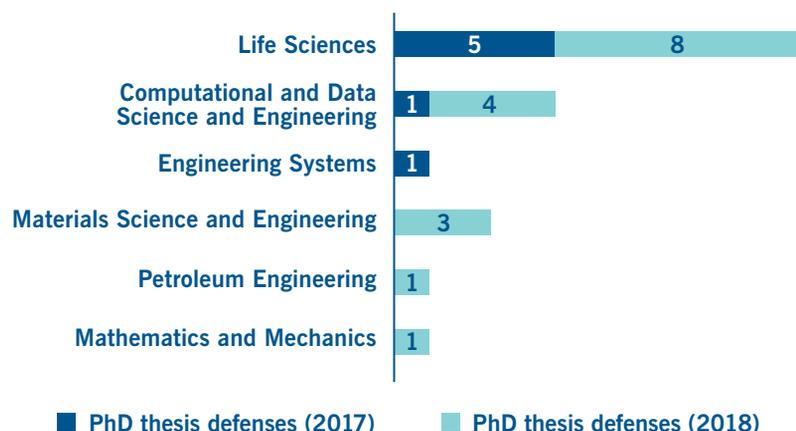
In 2018, Skoltech had its fourth year of graduation – 151 students successfully completed MSc studies and 25 PhD graduates received state diplomas.

MSc PROGRAM	MSc STUDENTS (2017)	MSc STUDENTS (2018)	MSc GRADUATES (2017)	MSc GRADUATES (2018)
Life Sciences	83	93	11	29
Data Science	130	177	25	50
Information Science and Technology	27	44	8	9
Space and Engineering Systems	53	67	12	18
Advanced Manufacturing Technologies	19	30	-	8
Materials Science	22	44	7	3
Petroleum Engineering	24	43	4	7
Energy Systems	19	27	10	6
Photonics and Quantum materials	29	48	7	11
Mathematical and Theoretical Physics	21	21	-	10
Total	427	594	84	151

PhD PROGRAM	PhD STUDENTS (2017)	PhD STUDENTS (2018)	PhD GRADUATES (2017)	PhD GRADUATES (2018)
Life Sciences	47	51	5	14
Computational and Data Science and Engineering	61	89	2	4
Engineering Systems	67	76	1	2
Materials Science and Engineering	34	51	-	3
Petroleum Engineering	27	51	-	1
Physics	27	36	-	-
Mathematics and Mechanics	14	29	-	1
Total	277	383	8	25

Skoltech has developed and approved a PhD Thesis Defense Policy in accordance with high international standards, which is unique

to the Russian higher education sphere. In 2018, 17 Skoltech PhD students from 6 PhD programs successfully defended their theses.



All PhD thesis defenses were carried out successfully:

Life Sciences doctoral Program

Maria Sokolova	Thesis title: Functional and Structural Analysis of a Non-canonical Multisubunit RNA Polymerase Encoded by Giant Bacteriophage AR9. Supervisor Prof. Severinov, Skoltech
Alexander Tyshkovskiy	Thesis title: Molecular Signatures and Mechanisms behind Lifespan Extension. Supervisor Prof. Khaitovich, Skoltech. Co-supervisor: Prof. Gladyshev, Harvard Medical School
Aleksei Mikhilchenko	Thesis title: Comparative Biology of Aging Through the Lens of Induced Pluripotent Stem Cells. Supervisor Prof. Khaitovich, Skoltech. Co-supervisor: Prof. Gladyshev, Harvard Medical School
Alexander Martynov	Thesis title: Using Mathematical Modeling to Understand Prokaryotic Adaptive Immunity. Supervisor Prof. Severinov, Skoltech. Co-supervisor: Prof. Ispolatov, University of Santiago Chile
Iliia Kurochkin	Thesis title: Comparative Analysis of Human Brain based on Mass Spectrometry Data. Supervisor Prof. Khaitovich, Skoltech.
Andrey Krivoy	Thesis title: Primed CRISPR-Cas Adaptation in Type I-E System of Escherichia Coli: Use of Single-Molecule and Biochemical Assays to Verify Models of the Phenomenon at Molecular Level. Supervisor Prof. Severinov, Skoltech
Anna Moroz	Thesis title: Preclinical Testing of New Modalities for PET Visualization and Treatment of RAS-Driven Cancers. Supervisor Prof. Severinov, Skoltech. Co-Supervisor: Prof. Evans, University of California.

Computational and Data Science and Engineering doctoral program:

Alexander Fonarev	Thesis title: Matrix Factorization Methods for Training Embeddings in Selected Machine Learning Problems. Supervisor Prof. Oseledets, Skoltech.
Evgeny Frolov	Thesis title: Low-Rank Models for Recommender Systems with Limited Preference Information. Supervisor Prof. Oseledets, Skoltech
Vadim Lebedev	Thesis title: Algorithms for Speeding up Convolutional Neural Networks. Supervisor Prof. Lempitsky, Skoltech

Petroleum Engineering doctoral program:

Tatiana Bondarenko	Thesis title: Evaluation of High-Pressure Air Injection Potential for In-Situ Synthetic Oil Generation from Oil Shale: Bazhenov Formation. Supervisor Prof. Cheremisin, Skoltech
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Materials Science and Engineering doctoral program:

Evgeniya Gilshteyn	Thesis title: Components for Stretchable Electronics based on Single-Walled Carbon Nanotubes. Supervisor Prof. Nasibulin, Skoltech
Aliya Glagoleva	Thesis title: Development of kW Scale Hydrogen Energy Storage System. Supervisor Prof. Stevenson, Skoltech. Co-Supervisor: Dr. Borzenko, Joint Institute for High Temperatures of RAS



ILIAS GIANNAKOPOULOS, *PhD student in Computational and Data Science and Engineering:*
“I decided to study under the Skoltech PhD program, because I was impressed by professors’ approach for novel and innovative ideas that support solid research. Moreover, Skoltech environment and facilities are favorable to international students. Last but not least, I enjoy working on challenging projects, and Skoltech provides this opportunity.”

Four graduates defended theses outside Skoltech in compliance with the requirements of the host institution or Russian State standards:

Andrey Chekannikov Thesis title: Electrode Materials for Sodium-ion Batteries Based on Polyanion-type compounds.
Supervisor Head of laboratory, T. Kulova, A.N. Frumkin Institute of Physical Chemistry and Electrochemistry RAS.
Place of defense – A.N. Frumkin Institute of Physical Chemistry and Electrochemistry RAS

Andrey Kuzmin Thesis title: Fast Methods for Dense Omega Correspondence.
Supervisor Prof. Lempitsky, Skoltech.
Place of defense – Federal Research Center “Computer Science and Control” of the Russian Academy of Sciences

Pavlo Gavrylenko Thesis title: Isomonodromic Deformations and Conformal Field Theory with W -symmetry.
Supervisor Prof. Opdam, University of Amsterdam, Prof. Marshakov, Skoltech. Place of defense – University of Amsterdam

Yulia Naraykina Thesis title: Coding non-coding Human Telomerase RNA.
Supervisor Prof. Dontsova, Skoltech, Prof. Rubtsova, MSU.
Place of defense – MSU

Each PhD Defense Jury consists of scientists with specific expertise relevant to the topic of the thesis. At least two of them are international experts from recognized universities and companies.

The list of institutions is presented below:

Russia Skoltech, Lomonosov Moscow State University, Institute of Molecular Genetics RAS, Dmitry Rogachev National Research Center for Pediatric Hematology, Oncology and Immunology, Higher School of Economics, A.V. Topichev Institute of Petrochemical Synthesis of the RAS, Kemerovo State University, Joint Institute for High Temperatures

Europe University College London, Max Planck Institute for Biology of Ageing, Max Planck Institute of Psychiatry, University of Zagreb, University of Bonn, Free University of Bozen-Bolzano, Technical University Darmstadt, University of Oulu, Lithuanian Energy Institute, University of Exeter, prudSys AG, Gravity R&D

Asia National University of Singapore, Tel Aviv University, RIKEN Center for Life Science Technologies

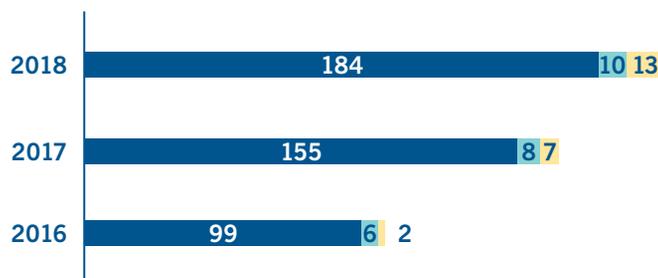
USA and Canada University of Illinois Urbana–Champaign, University of Georgia, Memorial Sloan Kettering Cancer Center, New York University, University of Houston, University of Calgary, University of the Western Cape, University of Rochester, Buck Institute for Research on Aging, NVIDIA

The **international accreditation** of graduate programs by the French High Council for Evaluation of Research and Higher Education (HCÉRES) in compliance with Standards and Guidelines for Quality Assurance in the European Higher Education Area was launched in 2018. The Life Sciences program was selected for accreditation as one of the first PhD programs with the largest number of graduates and thesis defenses.

As mentioned in the evaluation report of the HCÉRES Experts Committee, “the establishment of the Skoltech Life Sciences PhD program has been executed at the highest international standards.” This high praise is particularly important for Skoltech as a young international university and allows it to serve as an example to follow for other Russian institutions.

The key results in **programs development** for 2018/2019 academic year are:

- the range of courses was expanded to 207 curriculum elements,
- introductory courses were woven into curricula to assist students with different backgrounds to oversee research areas, choose educational track and organize rotation via laboratories: *Introduction to “Life Sciences” program; Introduction to Petroleum Engineering; Introduction to AMT; Introduction to Data Science; Introduction to IoT; Introduction to The Quantum Field Theory; Survey of Materials,*
- two new courses were offered to develop 1st year MSc students’ skills: English Toolkit and Mathematics for Engineers,
- the Entrepreneurship and Innovation (E&I) stream was expanded to 10 courses, and the number of courses focused on soft skills development increased to 13,
- the new course *Pedagogy of Higher Education* for PhD students was developed by Prof. M. Gustafsson (Chalmers University, Sweden). The course is an essential element of the doctoral study and focuses on practical pedagogical skills useful for the academic career. So far, 44 PhD students have successfully passed the course.



■ Courses in curriculum (total) ■ Entrepreneurship and Innovation courses (E&I) ■ Soft skills courses

The quality of courses and teaching is measured by student satisfaction at the end of each course. The anonymous online survey includes 10 questions with qualitative assessment of the course for further improvement. During 2018,

the Education Department collected student feedback on 180 courses. The average response rate has gradually increased from 40% in 2017 to 75% in 2018. Almost all courses received a high evaluation: >95% positive student feedback.

Fulfillment of the accreditation criteria

POSITIONING OF THE DOCTORATE	“The Life Sciences PhD Program is perfectly integrated into the general strategy of Skoltech as a part of the Institute in creating excellence in research and teaching”
ORGANIZATION AND MANAGEMENT OF THE DOCTORATE	“The organization of the PhD program is flawless. It is organized based on meritocratic values that are in full agreement with the institution’s and PhD program’s aim to become one of the leading research and teaching institutions in Russia and the world”
SUPERVISION AND TRAINING FOR DOCTORAL STUDENTS	“The supervision and training of students is conducted at highest international levels”
INTEGRATION OF DOCTORS INTO THE JOB MARKET	“Specific problems with respect to the job market have been identified and the Skoltech team works on their part to facilitate the integration of the doctors into the job market”
FINAL ASSESSMENT	“Considering the accreditation criteria analysis detailed above, the accreditation committee issues the following decision: “FIVE-YEAR UNRESERVED ACCREDITATION DECISION” ”



The Independent Study Period (ISP)

is a unique practice in the Russian higher education landscape. The Skoltech community and invited instructors are encouraged to create and deliver new courses to make the learning process interdisciplinary and to enhance professional and personal skills of Skoltech students. More than 300 Skoltech students participated in 31 selected ISP courses: *Pilot School*, *Science in Contemporary Art*, *Lean on Linux*, *Mysterious Russian Soul*, *Quantum Hackers Course*, *The Art of Public Relations*, *From Idea to Start-up*, *Introduction to Artificial Humor*, and others.

Academic mobility is a special facet of Skoltech education in the Russian context:

each student has an opportunity to participate in academic mobility from short programs, such as international conferences or summer schools, to long-term visits to partner host universities to conduct research. Academic mobility aims to immerse students into a global international ecosystem of science, research and innovations during study at Skoltech. A high participation of 417 students were supported for academic mobility, including 144 long-term trips for research. More than 80 universities and research centers hosted Skoltech students: MIT, California Institute of Technology, Technical University of Munich, Max Plank Institute, Pasteur Institute, Airbus, Facebook, etc.



The graduates of PhD Life Sciences program



ANNA DEREVNINA, *Associate Provost and Dean of Education*:

“In 2018, Skoltech began attaining international recognition of its education programs in compliance with Quality Assurance in the European Higher Education Area. The first Skoltech Life Science PhD program was successfully accredited by the High Council for Education of Research and Higher Education (HCERES, Paris, France). As mentioned in the evaluation report, “the establishment of the Skoltech Life Science PhD program has been executed at the highest international standards.” This high praise is particularly important for Skoltech as a young international university and allows it to serve as an example to follow for other Russian institutions.”

The role of the e-library and virtual resources, digital tools, and eLearning to encourage **Digital Learning Commons** expanded significantly in 2018. At the moment, students have access to 16 universal and topic-specific scientific databases, including Science Direct, Springer and IEEE, 4 bibliographic databases (Scopus, Web of Science, etc.) and patent database, CIPHER. A new product was introduced called ProQuest

Dissertations, which allows access to one of the world's largest global archives of dissertations and theses. Additionally, the research performance analytical tool, SciVal, was added to the list of subscriptions at the end of 2018. The basic needs for a broader range of scientific literature are covered by the Springer e-books collection, which is provided by the Russian Foundation for Basic Research (RFBR) grant.

	2016	2017	2018
Print books collection, numbers	400	700	930
E-books, numbers	0	220	370
Springer e-books provided by Russian Foundation for Basic Research (RFBR) grant, numbers	32,000	70,000	85,000
Full-text documents downloads from library data-bases, numbers	8,400	50,000	110,000

The number of full text scientific databases available for the students is constantly increasing. It is reflected in the increase in full-text document downloads. E-book versions of most of the required books are available directly via course syllabi pages hosted on the Canvas LMS.

The online course catalog (<https://www.skoltech.ru/en/education/course-catalog/>) contains the full syllabi of more than 200 courses and is now publicly accessible for all internal and external customers; the number of visits to the webpage is almost 3 times more than a year before.

	2016	2017	2018
Page views, number	41,000	70,000	186,000
Page views, % of total	11	11	28
Average page views/day, number	112	190	510

Canvas LMS is an instrument of teaching management and a useful tool of self-study for students. During the spring terms of 2018, the number of courses using Canvas was

about 60%, while during the fall terms about 90% of courses used Canvas as an essential part of their active learning approach.

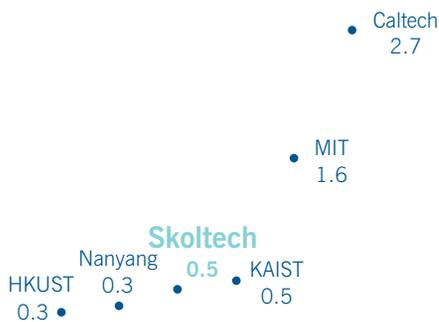
Research Excellence

The Centers for Research, Education and Innovation contributed to strengthening the institute's exposure in terms of **publication input**.

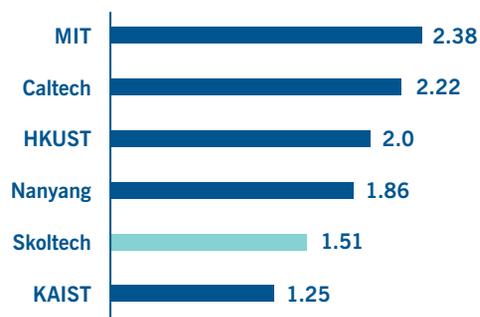
The six years record is presented with about 2,000 papers cited more than 16,000 times, while the output of 2018 includes 711 Skoltech affiliated papers (indexed in WoS,

Scopus)¹⁹, 60% of which are co-authored with international partners. For the second year in a row, Skoltech maintained 3rd place among Russian academic institutions in Nature Index (Subject, "Life Sciences") after the Russian Academy of Sciences and Lomonosov Moscow State University.

Papers in Nature Index journals by faculty headcount (2018)

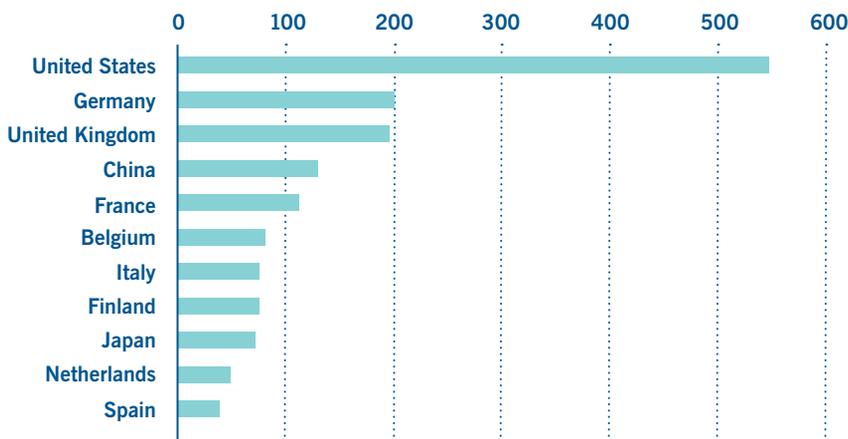


Scopus Field-Weighted Citation Impact (2015 – 2018)



Year of establishment: MIT (1861), Caltech (1891), KAIST (1971), Nanyang (1991), HKUST (1991), Skoltech (2011)

Top collaborating countries by publications (Scopus 2013-2018)

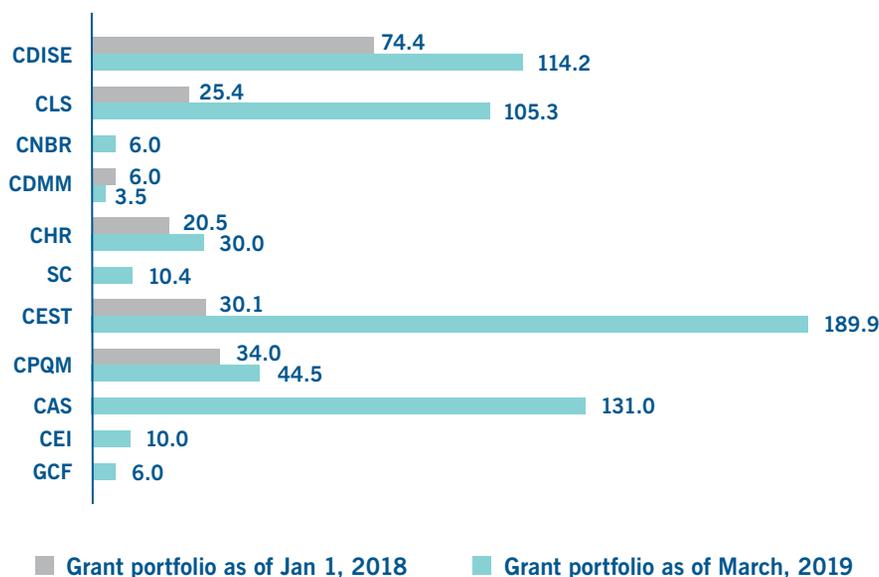


¹⁹ Scopus data as of March 1, 2019.

2018 saw a significant growth of the institute's research income raised on **national and international grants**. The grant funding in 2018 reached 234 mln Rub, 65% higher compared to the previous year. The total funding awarded on new proposals during 2018 is 370 mln Rub. Counting new grants awarded by March 1, 2019, the institute secured 650 mln Rub for the period of 2019 – 2022.

- For the fourth time, Skoltech received direct EU funding in the framework of Horizon 2020. Project name: “Integrating High Resolution Solar Physics” (2019-2022), PI: **Prof. Tatyana Podladchikova**.
- Russian Science Foundation grants within the President’s program for supporting world-class laboratories were awarded to **Prof. Artem Oganov** (Laboratory of Computer I Design of New Materials) and **Prof. Vladimir Zakharov** (Laboratory “Turbulence and coherent structures in integral and non-integral systems”).
- **Prof. Evgeny Burnaev's** project, “Making Machine Learning on Static and Dynamic 3D Data Practical,” will establish a mutually beneficial collaboration between Technische Universität München and Skoltech. TUM will gain access to expertise and innovative machine learning and deep learning algorithms, while Skoltech will benefit from significant expertise of TUM in visual computing (sponsored by the Russian Science Foundation).
- **Prof. Timofey Zatsepin's** project will aim to form the basis for a new approach in the cutting-edge technology of RNA therapy, which can be used also for orphan diseases and in personalized medicine (sponsored by the Russian Science Foundation).
- “My First Grants” (Russian Foundation for Basic Research) were received by **Anton Trofimov, Dmitry Aksenov, Olga Musharova, Sergey Shmakov, Artem Isaev, Maksim Panov, and Aleksey Frolov**.

Grant portfolio, mln Rub



The chart presents grant portfolio, e.g. total amount of funds secured for the upcoming period.

Skoltech continued a range of internal **research initiatives**. The Next Generation Program (NGP) projects were carried out in a broad range of areas by the Skoltech faculty and their MIT peers resulting in joint papers in high-impact journals (Nature Biotechnology, Nature Physics, Science, etc.), invention disclosures, and students' internships. Four projects were supported within the cross-CREI

Biomedical Initiative designed to prepare for collaboration with Moscow International Medical Cluster Skolkovo. The results were presented at the 3rd Annual Skoltech-MIT Conference, "Collaborative Solutions for Next Generation Education, Science and Technology."

The highlights of the CREIs research are presented further.



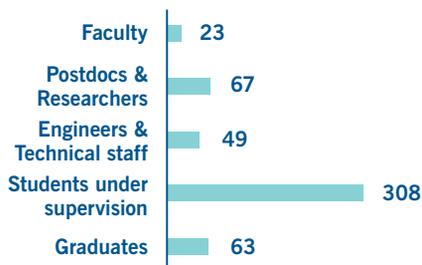
KEITH STEVENSON, *Associate Provost and Dean of Research:*

"The third annual MIT-Skoltech conference was structured predominately around 19 funded projects that support peer-to-peer and faculty-to-faculty research relationships. MIT remains a key partner and continues to develop strong relationships with Skoltech."

CENTER FOR COMPUTATIONAL AND DATA-INTENSIVE SCIENCE AND ENGINEERING

Director: Prof. Maxim Fedorov

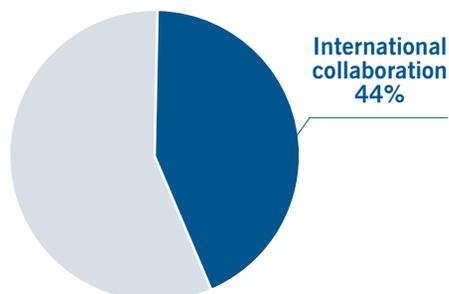
Human Capital 2018



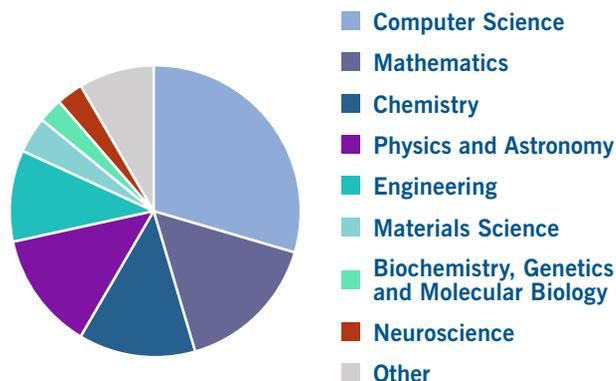
Overall research performance²⁰ (2015 – 2018)

Scholarly Output	299
Citation Count	2246
Citations per Publication	7.5
Field-Weighted Citation Impact	1.96

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



²⁰ Data on publication output in the CREIs is extracted from SciVal (as of March 1, 2019).

Key results 2018

The CDISE is leading in the area of development of AI/Big Data-focused computational systems and algorithms. The Centre hosts and maintains all major HPC/Big Data installations in Skoltech. In accordance to its strategic development plan, the CDISE team has recently (November 2018) installed the first AI-HPC cluster in Russia, “Zhores.” The system has a novel hybrid architecture specifically designed for AI & Big Data tasks and, in terms of computing power, it is currently #6

in Russia. The strategic plan of the CDISE is to become a national leader in HPC/AI and Big Data.

Another strategic area of the CDISE is the application of AI and Big Data techniques in Internet of Things and Wireless Communications. As was noted earlier, the CDISE has been recognized as the national leader in these areas and awarded a large (1B Rub) grant from the National Technology Initiative Platform for setting up the National Centre of Competence in these areas (led by Prof. Lakontsev).

The main results of the CREI are as follows:

- **Biomedicine:** Development of machine learning (ML) approaches for the analysis of *biomedical data*, e.g. 2D and 3D medical images have been elaborated, and provisional clinical testing of these new methods has been performed; the latter was accompanied by the implementation of elements of new computational techniques for advanced biomedical methods, e.g. high-resolution MRI.
 - **Digital Agriculture:** New approaches and algorithms based on mathematical modeling (MM) and ML have been developed for application in *smart agriculture*, with a focus on yield prediction, smart soil analysis and remote observation of plant fields.
 - **Computer Vision and Visual Analytics:** A set of new technologies, namely the auto-segmentation of complex scenes, and analysis of 3D/4D images has been elaborated and provisionally tested in projects supported by the Aeronet platform of the National Technology Initiative. These technologies include: (i) Urban Analytics Project – models for buildings’ instance segmentation and height estimation, models for building classification by type. (ii) Emergency Mapping Project – algorithm for analyzing satellite images of areas affected by fires and other natural disasters. (iii) Training Dataset with more than 20,000 objects of five classes labeled on VHR satellite and aerial images for the California Territory
- (US), Mytishi and Kazan Russia for developing deep neural networks.
 - **Digital Pharma:** Significant progress has been achieved in ML and MM applications for the discovery and development of *new bioactive compounds* with requested properties (including prediction of their toxicity). These results led to the launch of a start-up company, “Syntelli.”
 - **E-Sports:** Several problems of automated scene recognition with the use of ML as well as implementation of Artificially Intelligent Agents for games-related applications have been solved. The CDISE researchers have designed advanced architecture for data collection systems and investigation on the problems of sensors connectivity, synchronization, and sensor fusion. Two E-Sports-oriented startups, “Head Kraken” and “E-sports academy LLC,” have been launched.
 - **Internet of Things:** New non-orthogonal coding schemes for mMTC scenarios of 5G were developed, which is especially important in the context of massive Internet of Things applications; the approach can *significantly improve the performance of 5G LDPC codes* for a short length regime.
 - **Mobile Devices:** A new algorithm based on tensor decompositions has been developed for compression of deep neural networks without loss of accuracy; this provides a major potential impact for mobile

applications, where the memory and flops are crucial.

- **Automated Machine Learning:** a family of algorithms and software has been developed that automatically construct machine-learning models of interatomic interaction on-the-fly, reducing manual work-time – by factors of ten to hundreds – that is usually required for constructing such models. The results open new avenues for AI-based technologies in many areas, from the financial sector to predictive technical maintenance in aerospace and the oil & gas industry.
- **Mathematical Modelling:** a number of fundamental results were obtained in the modeling of granular flows, nonlinear plasma, and soft matter systems. Some of these results have been disseminated through national and international mass media, see e.g. <https://phys.org/news/2018-01-team-mysteries-saturn.html>

The CDISE researchers publish papers in the most prestigious journals in the field (highest rate of Q1 publications on AI/Big Data-related topics in Russia) and present their results at the most prestigious international conferences (largest number of papers presented on A/A* conferences in AI/Big Data among Russian research and educational organizations). Among the most notable is a breakthrough paper on deep learning in CVPR by Prof. Victor Lempitsky and PhD student, Dmitry Ulyanov, has already been cited 93 times; another paper with Valentin Khrulkov published in ICLR 2018 has been cited 20 times.

Prof. Andzej Cichocki, Prof. Evgeny Burnaev, Prof. Ivan Oseledets, Prof. Alexander Bernstein and Prof. Dmitry Dylov won the competition and were invited to organize the International

Workshop on “Deep Learning and Tensor/Matrix Decomposition for Applications in Neuroscience” in November 2018; it took place in Singapore jointly with the IEEE International Conference on the Data Mining series (ICDM 2018). The ICDM has established itself as the world’s premier research conference in data mining. The workshop had a high international impact and increased Skoltech’s visibility.

The CDISE faculty received a number of national and international awards, including the RF Presidential Award in Science & Innovation, the Scopus Russia Award 2018, the International Digital Signal Processing Society Award. Prof. Ivan Oseledets received a SIAM Award for Outstanding Paper prize in 2018 and the Huawei Award on best project implemented in production; several prize-winning awards have been obtained by CDISE members (mostly from Prof. Evgeny Burnaev’s group) at hackathons and competitions (International Data Science Game in Paris, International anomaly detection contest, Cyber security contest, etc.).

The CDISE is involved in worldwide scientific collaborations with many leading research institutes in Russia and abroad. Among these are the following: MIT, TUM, Technion, Tel-Aviv University, the University of Maryland, Ecole Polytechnique Paris, WIAS Berlin, Poznan University of Economics and Business, Boston University, the University of Leicester, Potsdam University, the University of Oulu, Moscow State University, the High School of Economics, Ioffe Institute of RAS, the National Research Centre “Kurchatov Institute,” Taiwan Technological University, the Institute of Catalysis of the Siberian Section of RAS, Ohio State University, the University of Geneva, Stanford University and others.

The CDISE is also active in developing professional education courses for leading Russian companies including Gazprom Neft and Sberbank.



MAXIM FEDOROV, *professor, Director CDISE:*

“Our center solves a broad range of interdisciplinary problems at a juncture with machine learning, artificial intelligence, data science and mathematical modeling. The idea to create a powerful, energy-efficient supercomputer with a hybrid architecture specially for machine learning and simulation based on data was conceptualized in 2017 as an answer to modern challenges in these fields. We hope that our creation of a modern computing infrastructure will help develop cooperation between Skoltech and a whole range of high-technology companies that are Skolkovo residents.”



CDISE Director Maxim Fedorov handing over the symbolic key to the supercomputer to Nobel laureate Zhores Alferov (1930-2019)

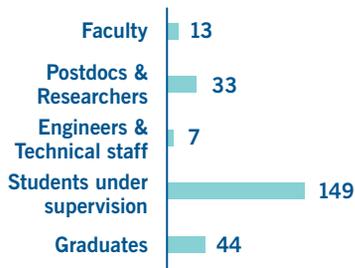


Supercomputer Cluster 'Zhores'

CENTER OF LIFE SCIENCES

Director: Prof. Konstantin Severinov

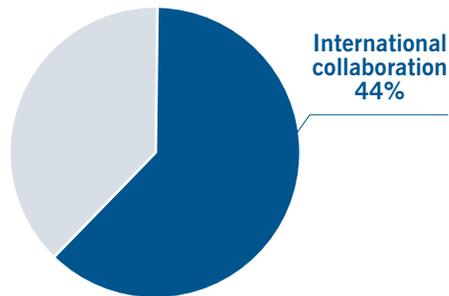
Human Capital 2018



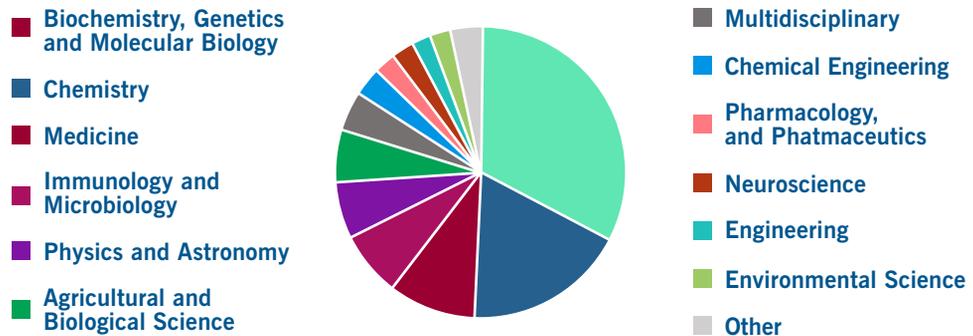
Overall research performance (2015 – 2018)

Scholarly Output	304
Citation Count	2927
Citations per Publication	9.6
Field-Weighted Citation Impact	1.76

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



Key results, 2018:

Functional and comparative genomics

1) It was demonstrated that the desiccation-rehydration cycle in a unique object, the African midge surviving 97% dehydration, is regulated by the transcription factor Hsf, which in other insects is the heat shock response factor. This is an example of evolutionary exaptation of an existing mechanism for a new task. The study combined the generation of large-scale transcriptomic data, bio-informatic analysis (performed by Skoltech researchers), and experimental validation of specific predictions.

2) The lactose operon of *Escherichia coli* is a textbook example of an operon that once earned its discoverers, Jacob and Monod, the Nobel Prize. Nobody has suspected that *E. coli* might have an additional lactose degradation locus. A study, with participation of Prof. Mikhail Gelfand and his group, showed that the locus initially described as involved in the sulfoquinovose catabolism indeed is involved in lactose utilization. An interesting twist is that several co-authors were high school students at the time of the research.

3) Bacterial species are routinely defined using arbitrary criteria such as 97% identity of 16S rRNA. A study, with participation of Prof Mikhail Gelfand and his group, suggested a new, evolutionarily meaningful definition of bacterial species based on identification of monophyletic and species-specific components of pan-genomes. Application of this criterion resulted in identification of cryptic species currently lumped under *Prochlorococcus marinus*, the latter being the most important source of oxygen.

4) *Holospora* are bacterial endosymbionts living in the nuclei of ciliate infusoria. Sequencing and genome annotation of a member of this genus and its comparison with other *Holospora* genomes resulted in description of the *Holospora* metabolic features and identification of *Holospora*-specific genes likely responsible for its unique lifestyle.

Adaptive bacterial immunity CRISPR-Cas systems

Ongoing work on basic biology of CRISPR and their practical use by the Severinov group resulted in several publications in top scientific journals. Research in this direction is supported by a large MES subsidy, a contract from JSC Biocad, Skoltech NGP and SBI and several RFBR grants. The patent rights of Skoltech for prior inventions of the Severinov group have been secured.

Antibiotics

Structural and functional analysis of biosynthesis of several novel oxazole-thiazole containing antibacterial peptides was carried out by the Severinov group and published in top international journals (*JACS*, *Mol. Cell*). A new high throughput platform for the screening of antibiotic producers in complex microbiota samples was carried out by the Severinov group in collaboration with the RAS Institute of Bioorganic Chemistry scientists (published in *PNAS*). Sergiev's group successfully applied the CRISPR-Cas9 genome engineering method to make cell and mouse lines deficient in several RNA methyltransferase genes. Additionally, they studied a functional role of the small mammalian mitochondrial peptide, overlooked by genome annotation.



Teaching lab at Skoltech Center of Life Sciences



Teaching lab at Skoltech Center of Life Sciences

Notable publications (in journals with IF ≥ 10), students are marked by *:

Davey, M. S., C. R. Willcox, S. Hunter, **S. A. Kasatskaya***, E. B. M. Remmerswaal, M. Salim, F. Mohammed, F.J. Bemelman, D. M. Chudakov, Y. H. Oo and B. E. Willcox (2018). "The Human V 2(+) T-Cell Compartment Comprises Distinct Innate-like V 9(+) and Adaptive V 9(-) Subsets." **Nat Commun** 9(1): 1760. Journal Impact Factor **12.353**

Ferreira, P. G., M. Munoz-Aguirre, F. Reverter, C. P. Sa Godinho, A. Sousa, A. Amadoz, R. Sodaei, M. R. Hidalgo, **D. Pervouchine**, J. Carbonell-Caballero, R. Nurtdinov, A. Breschi, R. Amador, P. Oliveira, C. Cubuk, J. Curado, F. Aguet, C. Oliveira, J. Dopazo, M. Sammeth, K. G. Ardlie and R. Guigo (2018). "The Effects of Death and Post-Mortem Cold Ischemia on Human Tissue Transcriptomes." **Nat Commun** 9(1): 490. Journal Impact Factor **12.353**

Hu, H., J. M. Liu, Z. Hu, X. Jiang, X. Yang, J. Li, Y. Zhang, H. Yu and **P. Khaitovich** (2018). "Recently Evolved Tumor Suppressor Transcript TP73-AS1 Functions as Sponge of Human-Specific miR-941." **Mol Biol Evol** 35(5): 1063-1077. Journal Impact Factor **10.217**

Hunter, S., C. R. Willcox, M. S. Davey, **S. A. Kasatskaya***, H. C. Jeffery, **D. M. Chudakov**, Y. H. Oo and B. E. Willcox (2018). "Human Liver Infiltrating Gammadelta T Cells are Composed of Clonally Expanded Circulating and Tissue-Resident Populations." **J Hepatol** 69(3): 654-665. Journal Impact Factor **14.911**

Khrameeva, E., I. Kurochkin*, K. Bozek, P. Giavalisco and **P. Khaitovich** (2018). "Lipidome Evolution in Mammalian Tissues." **Mol Biol Evol** 35(8): 1947-1957. Journal Impact Factor **10.217**

Klimuk, E., E. Bogdanova, M. Nagornykh, A. Rodic, M. Djordjevic, **S. Medvedeva***, O. Pavlova and **K. Severinov** (2018). "Controller Protein of Restriction-Modification System Kpn2I Affects Transcription of Its Gene

By Acting as a Transcription Elongation Roadblock." **Nucleic Acids Res** 46(20): 10810-10826. Journal Impact Factor **10.162**

Krivoy, A.*, M. Rutkauskas, K. Kuznedelov, **O. Musharova**, C. Rouillon, **K. Severinov** and R. Seidel (2018). "Primed CRISPR Adaptation in Escherichia Coli Cells does not depend on Conformational Changes in the Cascade Effector Complex Detected in Vitro." **Nucleic Acids Res** 46(8): 4087-4098. Journal Impact Factor **10.162**

Radovic, M., T. Killelea, **E. Savitskaya**, L. Wettstein, E. L. Bolt and I. Ivancic-Bace (2018). "CRISPR-Cas Adaptation in Escherichia Coli Requires Recbcd Helicase but not Nuclease Activity, is Independent of Homologous Recombination, and is Antagonized by 5' ssDNA Exonucleases." **Nucleic Acids Res** 46(19): 10173-10183. Journal Impact Factor **10.162**

Sergieiev, P. V., N. A. Aleksashin, **A. A. Chugunova***, Y. S. Polikanov and O. A. Dontsova (2018). "Structural and Evolutionary Insights into Ribosomal RNA Methylation." **Nat Chem Biol** 14(3): 226-235. Journal Impact Factor **13.843**

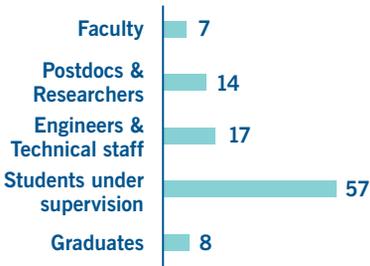
Travin, D. Y., M. Metelev, M. Serebryakova, E. S. Komarova*, I. A. Osterman, D. Ghilarov and **K. Severinov** (2018). "Biosynthesis of Translation Inhibitor Klebsazolicin Proceeds through Heterocyclization and N-Terminal Amidine Formation Catalyzed by a Single YcaO Enzyme." **J Am Chem Soc** 140(16): 5625-5633. Journal Impact Factor **14.357**

Yu, Q., Z. He, **D. Zubkov***, S. Huang, **I. Kurochkin***, X. Yang, T. Halene, L. Willmitzer, P. Giavalisco, S. Akbarian and **P. Khaitovich** (2018). "Lipidome Alterations in Human Prefrontal Cortex during Development, Aging, and Cognitive Disorders." **Mol Psychiatry**. Journal Impact Factor **11.64**

CENTER FOR DESIGN, MANUFACTURING AND MATERIALS

Director: Prof. Iskander Akhatov

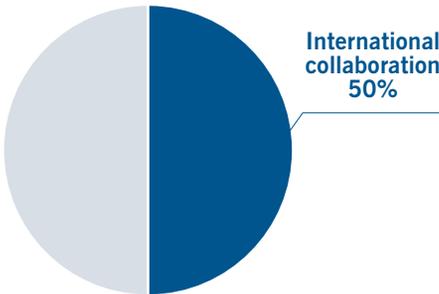
Human Capital 2018



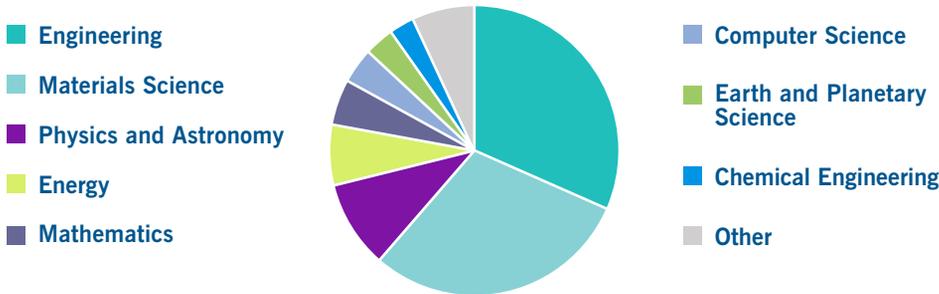
Overall research performance (2015 – 2018)

Scholarly Output	123
Citation Count	348
Citations per Publication	2.8
Field-Weighted Citation Impact	0.92

Papers in collaboration (2015 – 2018)

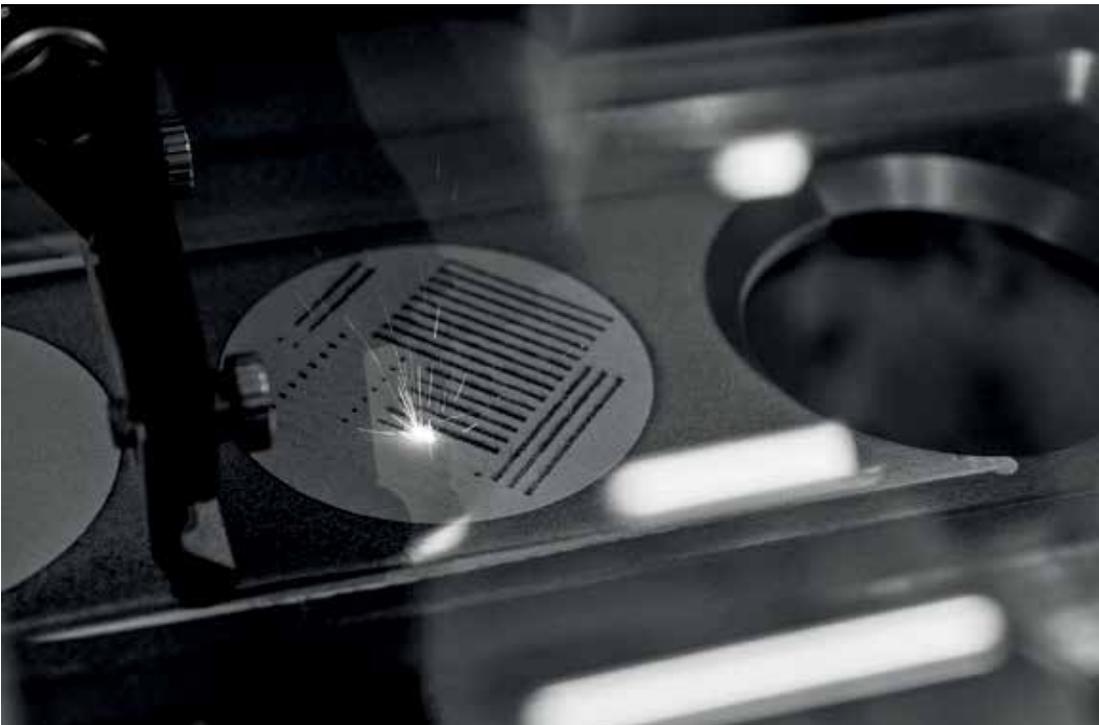


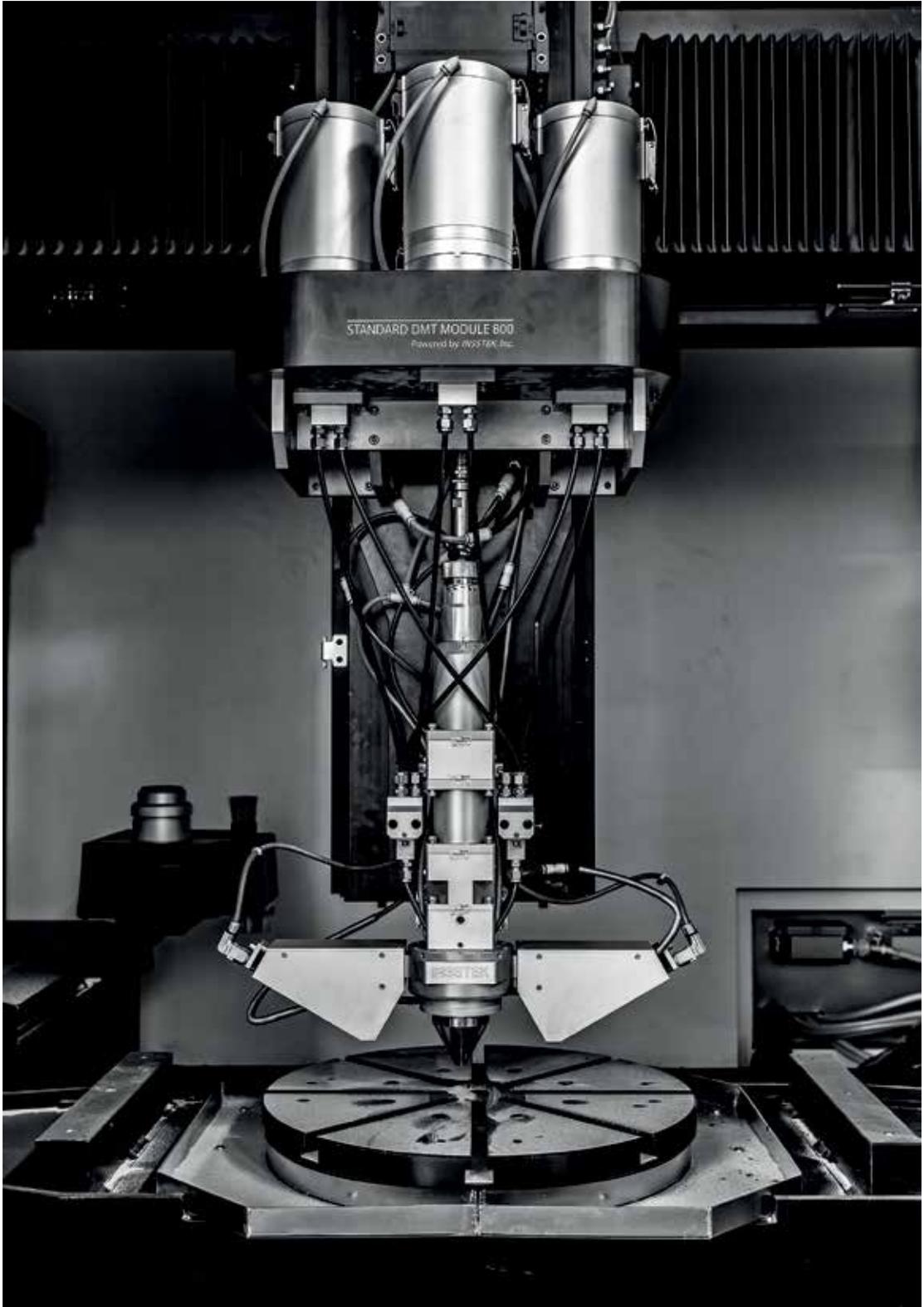
Papers by subject area (2015 – 2018)



Key results, 2018:

- Several excellent faculty, researchers, and postdoctoral students have been recruited. Five research laboratories have been established: the Composite Materials and Structures Laboratory, the Additive Manufacturing Laboratory, the Mechanical Testing and Materials Characterization Laboratory, the Information Technologies for Advanced Manufacturing Laboratory, and the Micro- and Nano-Mechanics Laboratory.
- Two synergetic educational programs have been developed and fully accredited: an MSc program in Advanced Manufacturing Technologies and a PhD in Mathematics and Mechanics. A full curriculum for these programs consisting of over 20 MSc and PhD level courses, taught by CDMM faculty, was developed. The number of PhD (MS) students has steadily increased.
- Several R&D initiatives and industrial projects were launched and/or executed by the Center. Two highly visible professional advisory services initiatives are currently approved by the National Technology Initiative office (Technet) with funding planned for 2018-2020.
- The project, “Development of Industrial Production Technology of Lightweight Perforated Honeycomb Core Aluminum Foil Structures for Spacecraft,” is being executed according to the contract with JSC ISS Reshetnev. This is the first successful experience in developing R&D collaboration with the Russian high-tech industry.
- Skoltech-Oerlikon Additive Manufacturing Laboratory was established in 2018. Both a cooperative research agreement and contract with Oerlikon have been signed. Oerlikon is going to fund three research projects over three years (2018-2020) with total funding of 864,000 Euro, with funding of basic charges for rent and furniture to a sum of 164,000 Euro. On top of this, Oerlikon is going to contribute to the joint laboratory with equipment for a total of about 1 million Euro.







CDMM Laboratory of Cyber Physical Systems

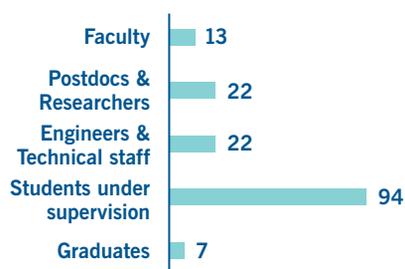


CDMM Mechanical Testing Laboratory

CENTER FOR HYDROCARBON RECOVERY

Director: Prof. Mikhail Spasennykh

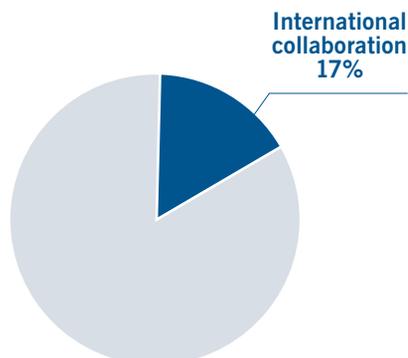
Human Capital 2018



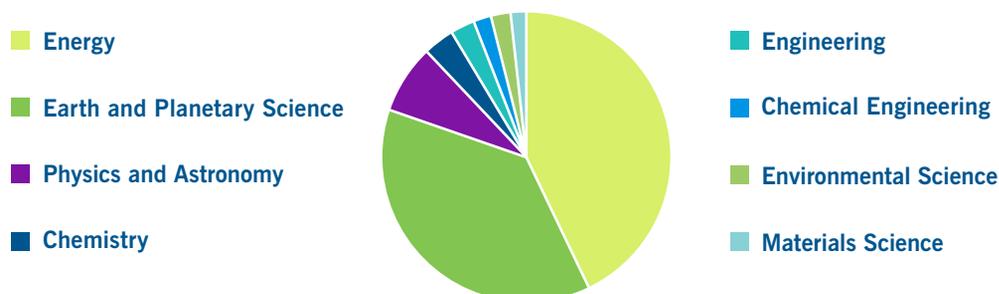
Overall research performance (2015 – 2018)

Scholarly Output	120
Citation Count	163
Citations per Publication	1.4
Field-Weighted Citation Impact	0.62

Papers in collaboration (2015 – 2018)

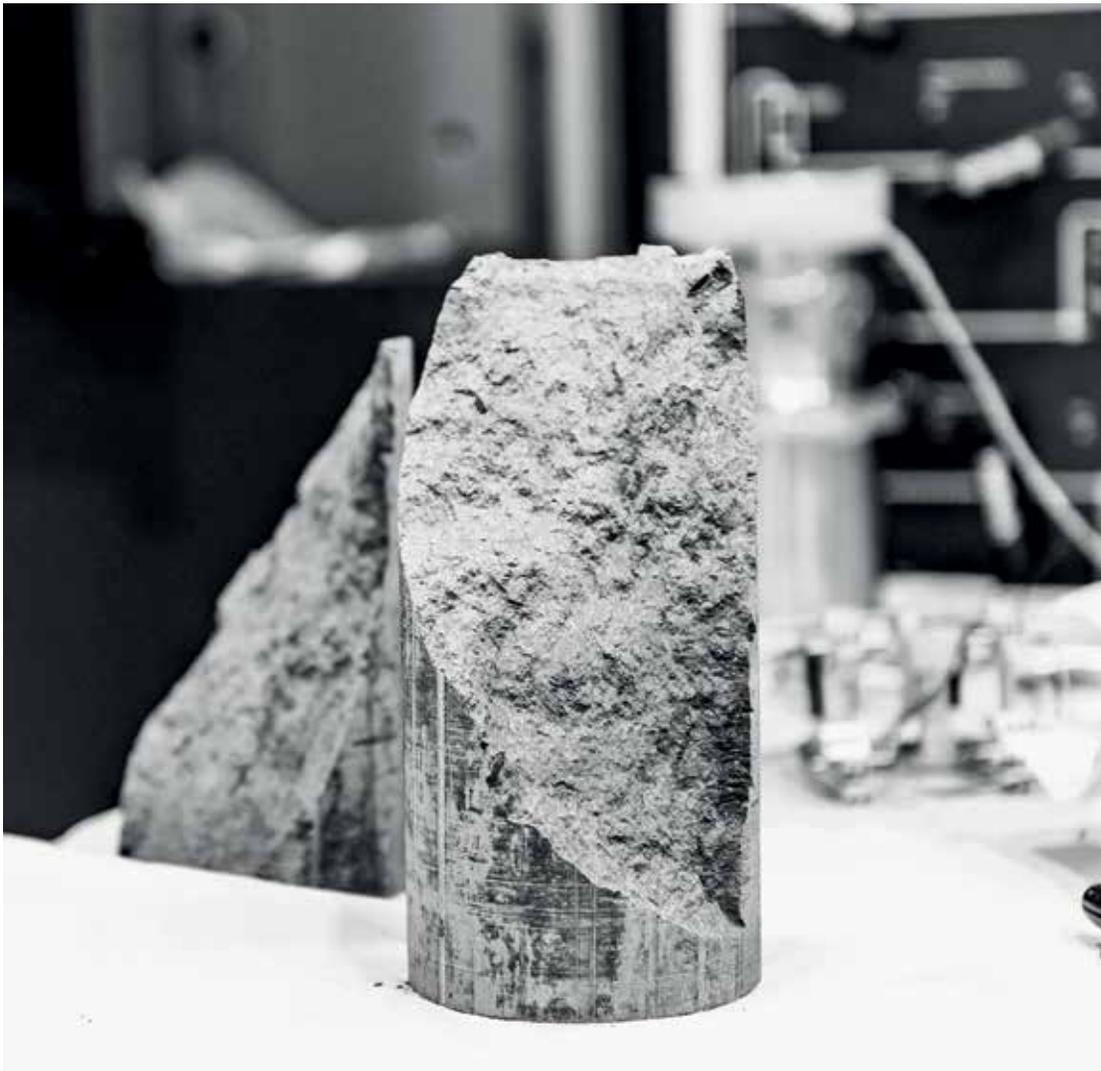


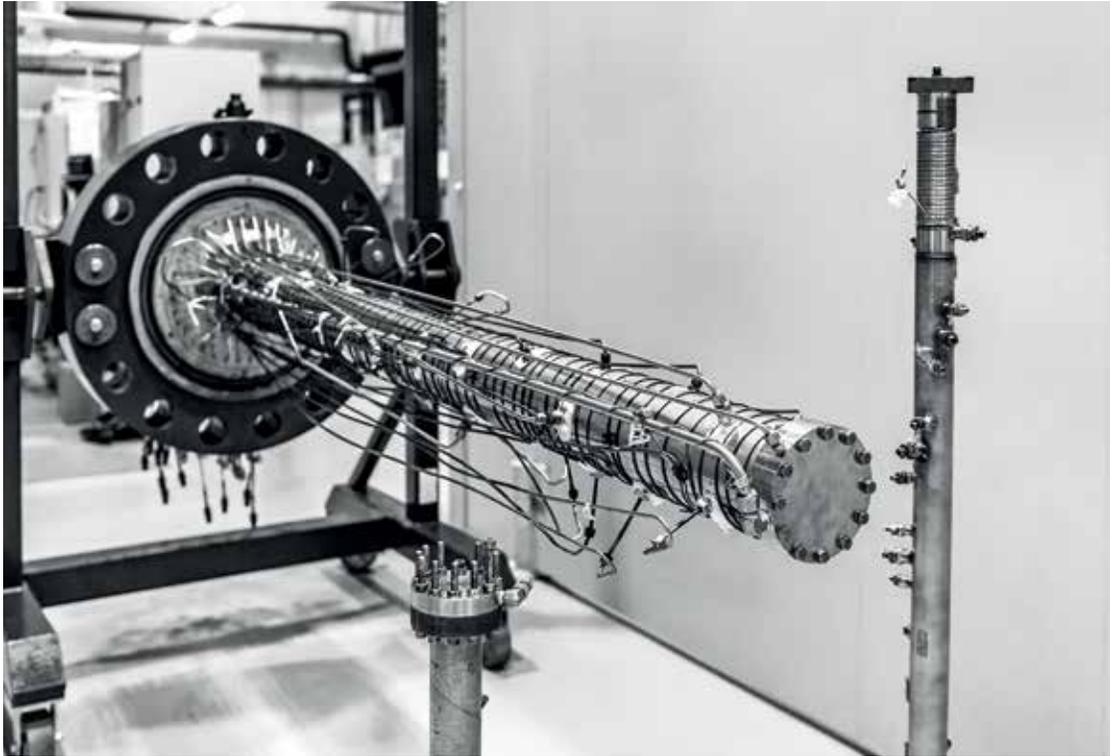
Papers by subject area (2015 – 2018)



Key results, 2018:

- The CHR commissioned and runs 24/7 a state-of-the-art laboratory with world-class equipment for development, testing and validation of new technologies for exploration and production of unconventional and hard-to-recover hydrocarbon reserves. Several unique experimental setups were installed and commissioned in 2018, such as an X-ray micro-CT scanner with an incorporated high-pressure and high-temperature filtration system, and a high-pressure/high-temperature miscible gas core flood system.
- In 2018, the CHR has significantly expanded its industrial R&D program. By year-end, the portfolio included 45 contracts with total funding exceeding 380 million rubles.
- The CHR research results have been presented in more than 100 industry research reports, and the related scientific results were published in more than 150 research papers, most of which are indexed in Scopus, Web of Science, and One Petro (the major database covering publications in areas related to oil and gas exploration and production).





Enhanced Oil Recovery Laboratory (CHR)



Enhanced Oil Recovery Laboratory (CHR)



Enhanced Oil Recovery Laboratory (CHR)

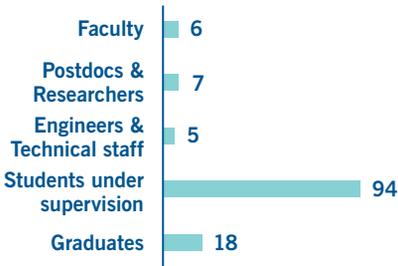


Enhanced Oil Recovery Laboratory (CHR)

SPACE CENTER

Director: Prof. Anton Ivanov

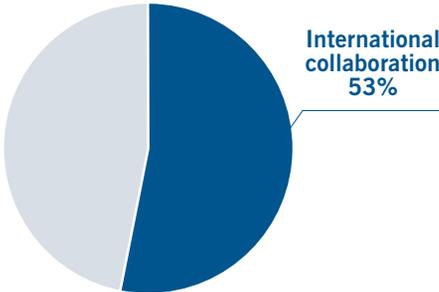
Human Capital 2018



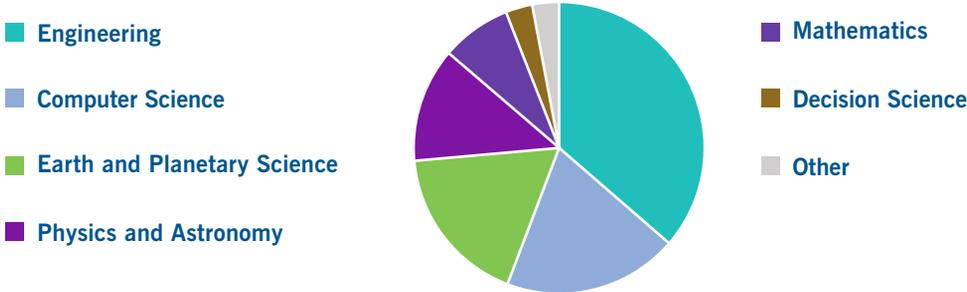
Overall research performance (2015 – 2018)

Scholarly Output	60
Citation Count	162
Citations per Publication	2.7
Field-Weighted Citation Impact	1.28

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



Key results, 2018:

In 2018, the Space Center advanced its projects in its three key areas, with focus on collaborations in Europe and Russia. Development focus was on industrial projects, which can benefit from the Center's experience in systems engineering.

Strategic Thinking

- The Concurrent Design Engineering Lab performed business case studies for Russian industry and external customers. Industrial studies included preparation of a financial assessment for a worldwide internet distribution from space assets. A study report was used when laying plans for a future Russian national constellation. A Space advertisement business case was evaluated for a commercial customer, thus celebrating the first paid study in CEDL. The methodology and key results were presented at the International Astronautical Union in Bremen (IAC 2018).
- A lunar project of a small science satellite was completed with a consortium of universities including PolyMilan, TU Delft and the European Space Agency.
- Active debris removal (ADR) from congested orbits is a solution to space pollution. The Space Center participates jointly with Ecole Polytechnique Federale de Lausanne (EPFL) in preparation of a strategy to finance ADR service.
- The research project for Airbus provides support for corporate technology road mapping to maximize the potential return of R&D investments through optimization of products and services in the group. The project is set to be completed in 2019 to provide recommendations to improve the corporate bottom line.

Advanced Engineering

- The Satellite Technology Lab has initiated a project on swarm satellite systems. Important stakeholders were identified and preliminary requirements for the project were drafted. 2020 is the target for the planned launch of the first prototype. Key partners are *RosCosmos, Moscow State University, Tomsk Polytechnic University, and the Far East Federal University*.
- The robotics group demonstrated a number of technologies at the IROS conference, including a swarm of drones, featured later in an IEEE publication.

Applications

- Prof. Podladchikova has received a highly competitive H2020 grant as part of a consortium (led by *TU Graz, Austria*) studying space weather.
- A number of industrial contracts were initiated, including application of hyperspectral remote sensing to forest taxation (with *Perm University*) and the creation of distributed ground stations for satellite telecommunications (with *Samara University*). These projects are supporting a countrywide program, "Planet Watch," to attract companies and students to the utilization of data from space services (remote sensing, navigation, telecommunications). This program is supported by the "*Talents and Success Foundation*;" the Foundation supports innovations (Bortnik) and ROSCOSMOS.



SC Intelligent Space Robotics Laboratory



SC Intelligent Space Robotics Laboratory



SC Intelligent Space Robotics Laboratory

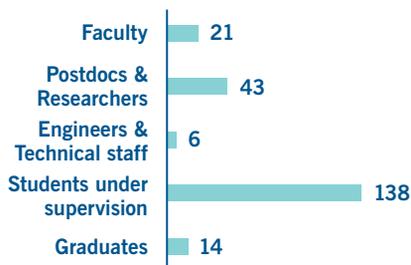


SC Intelligent Space Robotics Laboratory

CENTER FOR ENERGY SCIENCE AND TECHNOLOGY

Director: Prof. Keith Stevenson

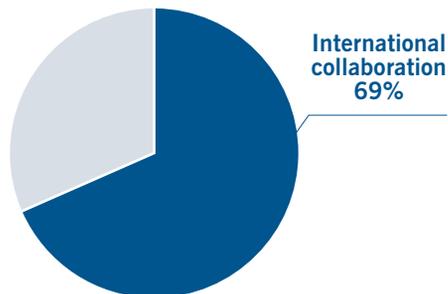
Human Capital 2018



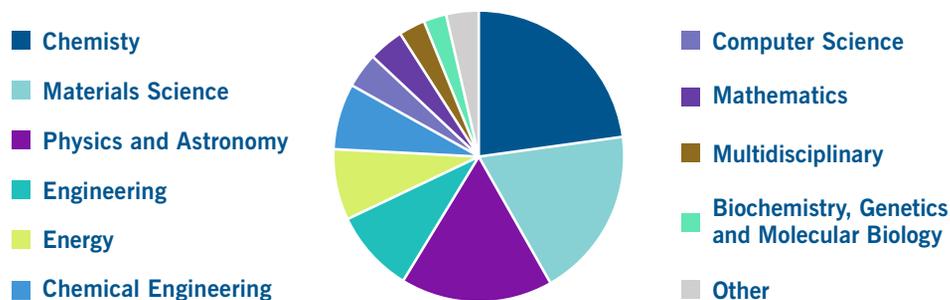
Overall research performance (2015 – 2018)

Scholarly Output	338
Citation Count	3145
Citations per Publication	9.3
Field-Weighted Citation Impact	1.87

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



Key results, 2018:

Over 167 publications indexed in Web of Science were published or in press in high-impact factor journals. 61% of these publications are published in the top 10% of journals worldwide.

- “The Role of Semilabile Oxygen Atoms for Intercalation Chemistry of the Metal-Ion Battery Polyanion Cathodes,” Tereshchenko, I.V., Aksyonov, D.A., Drozhzhin, O.A., Presniakov, I.A., Sobolev, A.V., Zhugayevych, A., Striukov, D., Stevenson, K.J., Antipov, E., Abakumov, A.M. 2018 Journal of the American Chemical Society with a field weighted citation index of 15.
- Developed detailed techno-economic models of Li-ion batteries (Gonzalez, Bisch, Pozo). This research developed a novel approach to power system operation when using electrochemical batteries.
- “2D Materials Worth Their Salt,” Oganov, A.R. 2018 Nature Chemistry with a field weighted citation index of 28; and “Accelerating High-Throughput Searches for New Alloys with Active Learning of Interatomic Potentials,” Gubaev, K., Podryabinkin, E.V., Hart, G.L.W., Shapeev, A.V. 2019 Computational Materials Science with a field weighted citation index of 34.38





CEST Energy Storage Laboratory



CEST Energy Storage Laboratory



CEST Energy Storage Laboratory

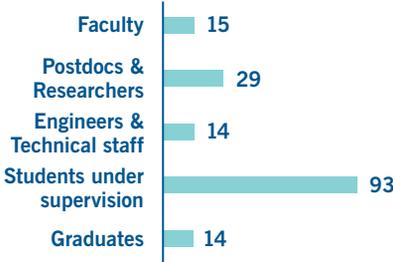


CEST Energy Storage Laboratory

CENTER FOR PHOTONICS & QUANTUM MATERIALS

Director: Prof. Franko Kueppers

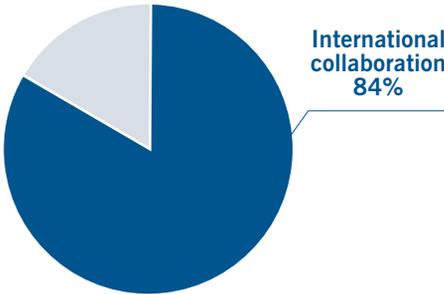
Human Capital 2018



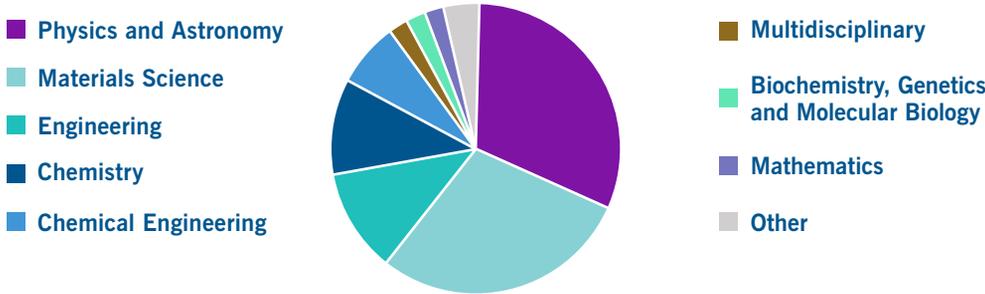
Overall research performance (2015 – 2018)

Scholarly Output	203
Citation Count	975
Citations per Publication	4.8
Field-Weighted Citation Impact	1.00

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



Key results, 2018:

In 2018, over 50 plenary and invited talks were given at international conferences. The main scientific achievements are as follows:

- A Charge Quantum Interference Device (CQUID) complementary to SQUID is implemented for the first time. A new device is based on coherent tunneling of vortices across a dirty superconducting wire. CQUID may be used for a future quantum current standard (V. Antonov) (Nature Physics).
- The light-induced melting of a charge density wave was investigated with time-resolved probes. The re-establishment of phase coherence is associated with annihilation of topological defects (B. Fine) (Nature Physics).
- A novel wet pulling technique to fabricate carbon nanotube fibers has been developed. The method is easily adaptive to different kinds of carbon nanotubes and allows rapid fabrication of both active and passive flexible electronic components (A. Nasibulin).
- A design of passive and active components of microwave photonics based on Si/ITO structures has been developed (V. Drachev).
- A new approach has been suggested for the detection of degradation drug delivery carriers in vivo by fluorescent tomography. It allows us to realize the remote-controlled release of bioactive substances under control of fluorescent tomography in vivo (D. Gorin).
- Spin polarization switching in polariton condensates in an optical trap was achieved via illumination with laser light (P. Lagoudakis).
- New designs are suggested allowing predominant emission of circularly polarized light from an unpolarized source in the absence of an external magnetic field (N. Gippius).
- The response of a superconductor to a weak microwave signal is calculated at arbitrary temperatures and radiation frequencies. The approach generalizing the old Eliashberg theory meets the needs of modern superconducting applications (M. Skvortsov).





CPQM Laboratory of Nanomaterials



CPQM Laboratory of Nanomaterials



CPQM Laboratory of Nanomaterials



CPQM Laboratory of Nanomaterials



Laboratory of Hybrid Photonics (CPQM)



Laboratory of Hybrid Photonics (CPQM)



Laboratory of Hybrid Photonics (CPQM)

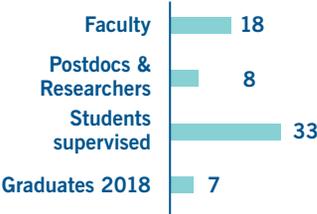


Laboratory of Hybrid Photonics (CPQM)

CENTER FOR ADVANCED STUDIES

Director: Prof. Igor Krichever

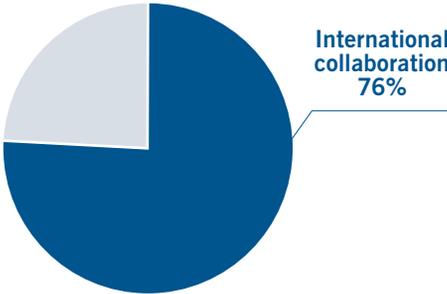
Human Capital 2018



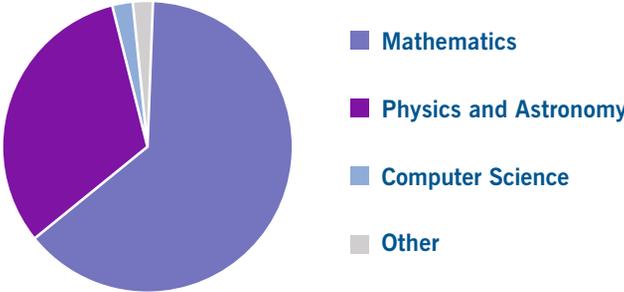
Overall research performance (2015 – 2018)

Scholarly Output	42
Citation Count	58
Citations per Publication	1.54
Field-Weighted Citation Impact	0.87

Papers in collaboration (2015 – 2018)



Papers by subject area (2015 – 2018)



Key results, 2018:

In 2018, the research achievements of the CAS members and students were recognized by awards (Prof. M. Finkelberg, Roman Gonin, and Prof. Mikhail Bershtein); Igor Makhlin was a winner of the “Young Russia Mathematics” prize for young researches.

Over 25 publications indexed in Web of Science were published in high impact factor journals in 2018 and 30 preprints prepared. Selected examples include:

M. Bershtein, P. Gavrylenko, A. Marshakov, “Cluster Integrable Systems, q -Painleve Equations and their Quantization,” *J. High Energ. Phys.* (2018) 2018: 77

M. Finkelberg, J. Kamnitzer, K. Pham, L. Rybnikov, A. Weekes, “Comultiplication for Shifted Yangians and Quantum Open Toda Lattice,” *Adv. Math.* 327 (2018) 349-389

A. A. Gaifullin, Y. A. Neretin, “Infinite Symmetric Group, Pseudomanifolds, and Combinatorial Cobordism-like Structures”, *J. Topol. Anal.*, 10(3) 605-625 (2018)

A. Liashyk, N. A. Slavnov, “On Bethe Vectors in gl_3 -Invariant Integrable Models,” *J. High Energ. Phys.* 6 (2018) 018

A. Losev, I. Polyubin, A. Rosly, “Ultraviolet Properties of the Self-Dual Yang-Mills Theory,” *J. High Energ. Phys.* (2018) 2018: 41

M. Semenyakin, G. Falkovich, “Alternating Currents and Shear Waves in Viscous Electronics,” *Phys. Rev. B* 97, 085127 (2018)

O. V. Ogievetskii, S. B. Shlosman, “Plane Partitions and Their Pedestal Polynomials,” *Mat. Zametki*, 103:5 (2018), 745–749

The CAS faculty members are highly visible organizers and participants in international conferences (over 50 invited talks). In 2018, the following conferences and workshops were organized:

Research Meeting “Infinite Dimensional Algebras, Geometry and Integrable Systems,” November 1-6, 2018 / Kyoto, Japan

Moscow-Pisa Colloquium, October 1-5, 2018

International conference “Topology and Physics,” September 5-6, 2018

International Conference “Conformal Field Theories in Higher Dimensions,” August 6-17, 2018

Pre-CQIS Summer School on Theoretical and Mathematical Physics, June 25-30, 2018

6th Workshop “Combinatorics of Moduli Spaces, Cluster Algebras, and Topological Recursion,” June 4-9, 2018

Conference “Algebraic Topology, Combinatorics, and Mathematical Physics,” May 24–30, 2018

Third school-conference “String Theory, Integrable Models and Representation Theory,” Moscow, January 21 – 27, 2018



MIKHAIL BERSHTEIN, *Associate Professor at Skoltech, winner of the 2018 Moscow Government Award for Young Scientists:*

“Skoltech has a lot of bright students that inspire you to hone your skills and learn new things.”



Igor Krichever, Professor, Director of Skoltech Center for Advanced Studies, at the conference "Algebraic Topology, Combinatorics, and Mathematical Physics" (May, 2018)



At the conference "Algebraic Topology, Combinatorics, and Mathematical Physics" (May, 2018)



At the conference “Algebraic Topology, Combinatorics, and Mathematical Physics” (May, 2018)



At the conference “Algebraic Topology, Combinatorics, and Mathematical Physics” (May, 2018)

Research Infrastructure

The institute's research infrastructure is a dynamic and vibrant part of development; the year was marked with establishing new laboratories as well as expansion of existing ones.

Data Science & Artificial Intelligence

- Several state of the art HPC clusters were installed. One of these is our flagship (AI-HPC) cluster for artificial intelligence and data-driven modeling, "Zhores," which boasts 0.5 Pflop/s performances (#6 in Russia) – a supercomputer with specialized architecture (104 NVIDIA Tesla V100 GPUs) tailored for deep learning applications.

Life Sciences & Health

- The Teaching Lab (Technopark) became operational. This lab enables delivery of two practical teaching courses (core curriculum of the CLS educational programs) and also allows limited research activity of CLS faculty members.

Cutting-edge Engineering & Advanced Materials

- The Composite Materials and Structures Laboratory, the Additive Manufacturing Laboratory, the Mechanical Testing and Materials Characterization Laboratory, the Cyber-Physical Laboratory, and the Micro- and Nano-Mechanics Laboratory (CDMM) became fully operational.
- The Laboratory of Unconventional Petro-Physics, Laboratory of Reservoir Geochemistry, the Laboratory of Geomechanics, the Laboratory of Enhanced Oil Recovery (chemical, thermal, gas and hybrid methods), the Laboratory of Gas Hydrates and Permafrost (CHR) became fully operational (Renova Lab building).
- The Robotics Lab invested heavily in precise positioning systems to control drones and other robots (SC).

Energy Efficiency

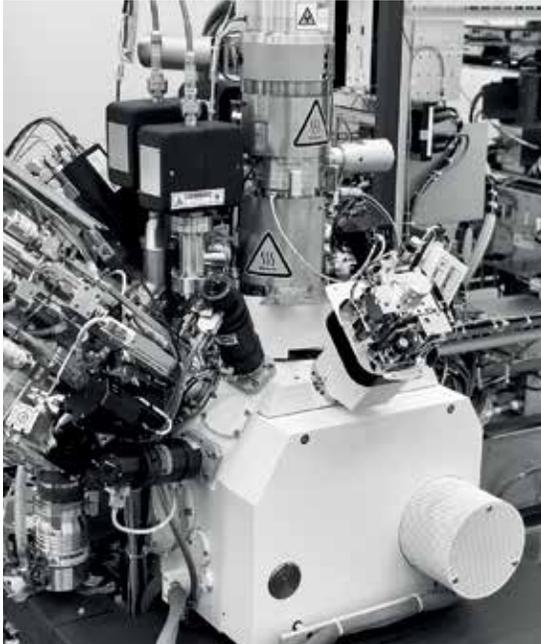
- The Smartgrids Lab for testing microgrid novel control technologies
- The Thermal Lab for hardware to study the meteorological impacts on the reliability of overhead power lines
- The Computational facilities
- Pilot scale facility for solution chemistry and hydrothermal synthesis of cathode materials (LFP, LFMP, NMC) in small kg batch quantities
- The Dielectric Lab for experiments to elucidate the fundamental atomic-molecular mechanisms of ionic transport and charge separation
- The Indoor Microclimate Lab (Polygon room) serves as the data acquisition system to control room climate in an energy efficient way and test optimized control strategies.

Photonics & Quantum Materials

- The Nanoplasmonics Lab (V. Drachev) (under installation)
 - The Biophotonics Lab (D. Gorin) (under development)
 - The Time and Frequency Research (Atomic Clock) Laboratory (under development)
-

SHARED FACILITIES

Skoltech Shared Facilities were further developed to support the institute in performing cutting-edge basic and applied research as well as delivering educational excellence. With over seven state-of-the-art laboratories stretched across more than 10,000 sq. meters, when fully relocated and started up on-campus, Skoltech Shared Facilities will generate value and bring expertise to internal as well external customers and partners.



Advanced Imaging Core Facility



FabLab and Machine Shop Shared Facility



FabLab and Machine Shop Shared Facility



FabLab and Machine Shop Shared Facility

In 2018 Skoltech established:

- Genomics Core Facility (headed by Dr. Maria Logacheva);
- FabLab and Machine Shop (headed by Vladimir Kalyaev);
- Advanced Imaging Core Facility (headed by Prof. Artem Abakumov);
- Micro- and Nanofabrication Cleanroom (headed by Prof. Vladimir Antonov);
- BioImaging and Spectroscopy Core Facility (headed by Prof. Dmitry Gorin).

Shared Facilities Development Plans, specifying equipment, space, staffing structure, as well as planned budget were developed and presented to the Academic Council. Each Facility established its Expert Council (governing committee) presented by Skoltech and external experts, who provide recommendations on issues of strategic planning (focus areas, infrastructure, and services).

As of December 2018, Genomics, FabLab and Machine Shop, BioImaging and Spectroscopy were fully functional at the Skoltech interim campus. The Advanced Imaging, Micro- and Nanofabrication Cleanroom will start their operations on-campus directly. The establishment of Advanced Mass Spectrometry was in progress.

The Genomics Core Facility (GCF) was established in March 2018, as a spinoff from the CLS, to coordinate and support genomic research programs carried out by Skoltech researchers, participants of the Skolkovo ecosystem as well as external customers. The facility is equipped with high throughput Illumina sequencers HiSeq4000 and MiniSeq, equipment for nucleic acid extraction, library preparation and quality control (Illumina cBot 2, Biomek NXp Span-8, Covaris M220, Bioanalyzer 2100 etc.), auxiliary sample preparation tools as well as computational resources for data storage and analysis.

The GCF became the institute's first unit and a model for others in terms of operation. The CLS faculty, along with the Shared Facilities Office, was spearheading this effort using the best practices from international research universities. Since its establishment, multiple sequencing projects have been

implemented at the GCF, both for internal and external customers. The GCF has provided a regular sequencing service for biomed MSc and PhD students.

In October 2018, the facility participated in a program of large research infrastructure facilities organized by RSF and received 24 applications from potential customers.

The FabLab and Machine Shop Shared Facility (FabLab) was established in October 2018 based on the Student Masterskaya. The facility is equipped with a wide range of machines, tools, and technological chains to fabricate, analyze, repair, and improve a broad range of materials, parts and pieces. The precision quality of certain characterization tools is better than 2µm. Professional quality rapid manufacturing and technical consulting are the key features to succeed in both research and educational activities. Unlike external facilities, for requests of moderate complexity the FabLab and Machine Shop Shared Facility operates on a “next day delivery” principle, bringing researchers, industry and students flexibility when planning their activities.

FabLab was actively involved in education, providing working space, personnel, tools, machines and all supplies necessary for student courses; R&D works for both internal and external customers, ranging from the consulting stage to implementation of customer ideas based on knowledge and experience of facility staff, manufacturing, hosting competitions and hackathons, and supporting start-up companies.

The Advanced Imaging Core Facility (AICF) was established in September 2018 to provide top-level advanced electron microscopy services to support research in both the academic and industrial sectors at Skoltech, within the Skolkovo ecosystem, and for external partners. The AICF is equipped with three electron microscopes, including an aberration-corrected FEI Titan Themis Z transmission electron microscope with a monochromated electron source, Super-X system for energy-dispersive X-ray analysis, a high-resolution EELS spectrometer, electron tomography setup and a versatile set of sample holders. The dual beam system FEI Helios G4

Plasma focused ion beam machine and Quattro S scanning electron microscope provide possibilities for site-specific TEM sample preparations, slice-and-view tomography, surface imaging, morphology studies, and compositional analysis.

After starting-up in Skoltech campus in Q1-Q2 2019, the facility will provide services to customers according to the highest international standards.

The Micro- and Nanofabrication Cleanroom

(Nanofab) was further developed to support high-tech R&D projects carried out by Skoltech researchers, participants of Skolkovo ecosystem and external customers. The facility will be equipped with nanofabrication equipment of high specification and it will be managed by a team of experts enabling efficient research and development in the fields of modern semiconductor photonics, processing of 2D materials and superconducting coherent circuits. The facility is expected to begin operation by the end of 2020.

The Nanofab is designed as a flexible technological platform for fundamental research and a prototype of industrial manufacturing. The knowledge database will be developed as a synergy of technological and intellectual input from fundamental science and industry-oriented research. PhD students, postdocs, researchers, engineers and technicians will be the intellectual foundation of the Nanofab knowledge base. Facilities will be open 24/7 for users, ensuring efficient usage of equipment and intensive R&D. With world-class equipment, expertise and scale, the Skoltech Nanofab will respond to the needs of modern R&D of components for high-tech products as well as fundamental scientific research. Its broad range of capabilities as well as extensive experience of facility staff will be unique in Russia and will allow for the solving of a wide variety of scientific, research and practical tasks.

The Biolmaging and Spectroscopy Core Facility

(BISCF) was established in October 2018 to provide cutting edge technologies for in vitro/in vivo imaging and spectral analysis using photonic tools for Skoltech researchers, members of the Skolkovo ecosystem as well as external customers. The creation of the BISCF is the result of collaboration between CPQM (Plasmonics Laboratory headed by Prof. Vladimir Drachev and the Biophotonics Laboratory headed by Prof. Dmitry Gorin) and CLS (Prof. Konstantin Lukyanov and Prof. Timofey Zatsepin).

The expertise of the Biolmaging and Spectroscopy Core Facility covers several fields, including photonic and plasmonic tools for spectroscopy and imaging as well as materials science, chemistry and biology for targeted delivery and biosensing. The broad range of capabilities as well as the extensive experience of facility staff allow for the solution of a wide variety of scientific, research and practical tasks in the fields of biology, medicine, pharmacology, cosmetology, food industry, and advanced technology. Over the course of 2018, the Biolmaging and Spectroscopy Core Facility was actively involved in R&D projects for both internal (Skoltech) and external customers. Since its start and over a period of less than two months, the facility contributed to 1 external and 4 internal projects. The facility participated in the program of large research infrastructure facilities organized by RSF and received 7 applications from potential customers.

The identification and establishment of new-shared facilities is an ongoing process, reflecting current and prospective needs of Skoltech CREIs in terms of acquiring research equipment as well as starting collaboration with academic and industrial partners. In order to coordinate the establishment and management of successful operations as well as oversee the future development of Skoltech Shared Facilities, the Shared Facilities Office (headed by Dr. Alexey Denisov) was established subordinated to the Dean of Research.



MARIA LOGACHEVA, *Director of Genomics Core Facility and winner of 2018 Moscow Government Award for Young Scientists:*

“Managing the Skoltech Genomics Core Facility sets new goals that help to broaden our horizons in genomic research and work on exciting projects. While further developing our Facility, I expect to explore new methods, such as monomolecular sequencing.”



Genomics Core Facility



FabLab and Machine Shop Shared Facility



FabLab and Machine Shop Shared Facility



Genomics Core Facility

Integrating Innovation

In pursuing its mission, Skoltech fosters and links education and research with innovation and entrepreneurship. The overarching goal is to instill a culture of innovation and entrepreneurship in research and education across traditional disciplinary boundaries.

Serving as an introduction to the Skoltech approach to education and entrepreneurship, **the Innovation Workshop (IW)** is generally the first course that students take when starting their experience at Skoltech. The Innovation Workshop, 2018, featured many new elements including, for the first time, the active participation of over 30 international mentors and speakers, a customer-centric organizational team, and a substantial networking and social media program.

During this “boot camp” style, month-long learning experience, students were challenged to work with technological innovation in a collaborative environment – something that is essential to the Skoltech reality. In 2018, more than 350 incoming students learned from distinguished Skoltech professors, specialists and mentors from around the world, and worked under their guidance to develop the knowledge and skills essential for both their experience at Skoltech and the post-graduate future in their prospective career fields.

Far from an abstract idea, the innovative projects developed during the IW were meant to tackle “real world” problems and prepare students for the spirit of innovation and entrepreneurship they will be immersed in throughout their time at Skoltech. Going forward, students will be able to continue developing their successful ideas, with the help of Skoltech.

The learning at Innovation Workshop takes place with combination of:

- Quick Success projects (three one-day team projects during the first week),
- Morning and evening “glue lectures,”
- Lectures on business fundamentals and innovation,

- VIP lectures from noted personalities such as Dr. Charles Cantor, a world-renowned expert in biophysical chemistry; Thierry Chevalier, who leads the digital design manufacturing activities at Airbus; Simon Bradley, Senior Vice President of Cyber Security at Siemens; renowned Finnish entrepreneur, Pekka Viljakainen; and, Munich based incubator and founder, Dr. Johann Fuller, among many others,
- Leadership and teamwork exercises,
- English-language and presentation-skills training,
- Presentations on project topics by select Skoltech faculty members,
- An extensive curriculum, including the “Innovating” textbook by MIT Professor Luis Perez-Breva, and
- The innovation project (one team project involving daily teamwork).

Student feedback about the IW was very positive. Participants evaluated it as useful for developing practical skills (80%). More than 75% of students mentioned that the atmosphere of IW was inspiring for active learning while the course content was challenging enough.

Providing hands-on experience in high-tech companies for students in the middle of MSc programs, the **Industrial Immersion** resulted in 147 projects completed by 213 students in 102 companies such as Astra Zeneca, BIOCAD, Bosch, British Petroleum, Deloitte, Gazprom Neft, Google, Huawei, Lukoil, Megafon, NVIDIA, Philips, Rosneft, Rostelecom, RusHydro, Samsung, Sberbank, Siemens, Tinkoff Bank, Yandex, Zarubezhneft, and many others.

The number of student team projects grew to 21%, e.g. 8% higher than in the previous year. 90% of projects were located in Russia, mostly in Moscow and Moscow Region, but also in Astrakhan, Krasnodar, Novosibirsk, Saint Petersburg, Sochi, and Vladimir. Some students experienced industry immersion abroad – Athens, Bengaluru, Berlin, Hamburg, Hannover, Havana, Islamabad,

Leiden, Madrid, Neuchâtel, San Francisco, Sendai, Stockholm, Tel Aviv, Toronto, Toulouse, Winnipeg, and Zurich.

Interest in hosting Skoltech students for industrial immersion among high-tech companies increased: 75% of companies in 2018 were new, compared to the list from 2017. For example, in the Energy Systems educational program there was an absolutely new set of partners compared to 2017 (System Operator, RusHydro, Siberian generating company, Siemens). In Materials Science, Bosch and InEnergy were complemented with 6 new companies, including Liotech, the biggest on the Russian market. A new set of strong private companies appeared in photonics, such as Skontel and Avesta. Skoltech startups also began to take students for industrial immersion, e.g. Tsuru Robotics. At the same time, some programs kept a stable portfolio of partners – for the second year in a row Gazprom Neft and Zarubezhneft are successfully hosting students from the Petroleum Engineering program for team projects.

More foreign companies (R&D departments in Russia) became partners for the Industrial

Immersion program (e.g. Phillips, Samsung, NVidia). For example, Samsung took the biggest number of data science students in 2018; while in the previous year the main companies were Yandex, Datadvance, S7, and Mimimax94.

Industry Day 2018, is a large conference of the Industrial Immersion program that includes poster sessions, industrial tables and seminars on top technological topics, with participation of Skoltech professors, students and representatives of 110 high-tech companies.

Created in 2012 in collaboration with MIT, **the Skoltech Translational Research and Innovation Program (STRIP)** provides critical support for translational research and funding for institute-based early stage projects. Aimed at bridging the gap between laboratory and marketplace, and to drive innovation and entrepreneurship, the program supports project teams to help establish proof of concept and advance their technology towards commercialization, including pre-startup identification of high potential market opportunities, intellectual property management and, if appropriate, team development.



LAWRENCE STEIN, *Vice President for International Business Affairs, Intellectual Property:*
“The Innovation Workshop is key to Skoltech’s mandate as an applied research institute with a strong emphasis on entrepreneurship and commercialization. In addition to our own faculty, who are supported by researchers and PhD students, this year’s workshop brings in more than 20 international mentors – providing unique perspective on how to succeed in today’s business environment.”



Skoltech Innovation Workshop (September 2018)



Skoltech Innovation Workshop (September 2018)



Skoltech Innovation Workshop (September 2018)



Skoltech Innovation Workshop (September 2018)

In 2018, the following seven projects have completed the 2017 – 2018 Program:

Magic carpets Prof. Victor Lempitsky (CDISE)	<ul style="list-style-type: none">• marker design/marker detection algorithm for VR applications is developed• system design with a slanted mirror developed• 2 RU patents• 1 PCT application
Flexible ultrasound module Prof. Albert Nasibulin (CPQM)	<ul style="list-style-type: none">• prototype of thermoacoustic ultrasound generator is developed• 1 RU patent application• communication with Spetsmash, Marvel Minds
Components for stretchable skin-like electronics Prof. Albert Nasibulin (CPQM)	<ul style="list-style-type: none">• temperature sensor based on nanomaterials is developed• application software is developed• 1 RU patent application• communication with Star Tech Ventures
Development of new method and technology for investigations of traditional and unconventional hydrocarbon reservoirs Prof. Yuri Popov (CHR)	<ul style="list-style-type: none">• new measuring equipment and technology for both hydrocarbon and geothermal reservoir characterization developed• 2 RU patent applications• attracted 5,8 mln RUB from Lukoil• startup, “Thermal Petrophysics,” created and supported by FASIE (1,0 mln. RUB)
Sense2beat (previous Cardiolog) Prof. Tatiana Podladchikova (SC)	<ul style="list-style-type: none">• prototype of a wearable ECG patch for cardiac arrhythmia monitoring is developed• noise cancellation algorithm of an ECG signal is developed• detection algorithm of an ECG waveform characteristics for further cardiac arrhythmia analysis is developed• 3-d place in Sevan Startup Summit, awarded by the President of Armenia• Shortlisted to 100 best startups to participate in SLUSH-2018• received Skolkovo residency• startup Sense2beat created
PickToGo: Development of picking robotic platform for warehouse auto-mation Prof. Dzmitry Tsetserukou (SC)	<ul style="list-style-type: none">• prototype of robotic platform is developed• localization and navigation algorithms in dynamic environment are implemented• communication with Sberbank, Decathlon, Ozon, and Okey
Advance Ion-exchange Membranes for Redox-flow batteries Prof. Keith Stevenson (CEST)	<ul style="list-style-type: none">• 5-stack cell prototype is developed• 1 RU patent application• communication with Solar Systems, Teemp, Russian Railways, Fumatech.

In 2018, the following new seven projects were selected for the 2018-2019 program:

Development of potassium-ion batteries
Prof. Artem Abakumov (CEST)

- new K-ion electrolyte and cathode materials are developed
- applied for Skolkovo residency
- first commercial contract with LG Chem
- communication with LG, Liotech, Saturn, InEnergy

Pultrusion structural profiles based on fibre reinforced thermoplastic pre-impregnated materials
Prof. Iskander Akhatov (CDMM)

- thermoplastic reinforced material is developed
- received Skolkovo residency
- startup T-Tech created
- communication with Invest-Trade

Metagenomic approach for oil and gas industry
Prof. Mikhail Gelfand (CLS)

- 147 samples from Rosneft well are obtained and analyzed
- communication with Rosneft, Sibur, Lukoil

Platform for Detection of Human Health Markers at Point-of-Care (POC): An Interface of the Physical and Life Sciences
Prof. Dmitry Gorin (CPQM)

- microfluidic chip design is developed, chip assembled
- passed preliminary expertise for Skolkovo residency
- communication with N.N. Blokhin Cancer Research Center

Strong coaxial filament for 3D printing
Prof. Albert Nasibulin (CPQM)

- prototype of coaxial extrusion head is developed
- first coaxial filament samples are 3D printed
- received Skolkovo residency
- startup Novaprint 3D created

G(ame)-psycho
Prof. Andrey Somov (CDISE)

- hardware platform with external sensors is developed
- passed preliminary expertise for Skolkovo residency
- received RFBR funding (4 mln RUB) for 1 year
- communication with Nike and MTS

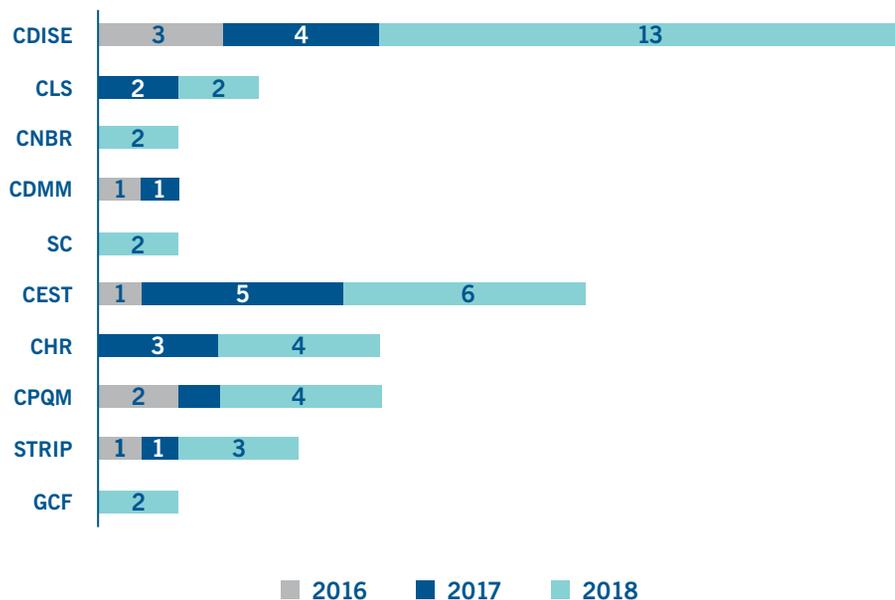
Syntelly – Computer aided organic synthesis
Prof. Maxim Fedorov (CDISE)

- deep neural network-based system for acute toxicity profiling of organic compounds is developed
 - received Skolkovo residency
 - startup Syntelly created
 - communication with Elsevier, ImG, Orgsyn, Migo-Group
-

Patent activity in 2018 showed a significant increase. 38 applications were submitted to the national and international patent offices; among the international applications were:

- Virtual Reality System Based on Smartphone with Slanted Mirror (PCT/RU2018/000452) V.Lempitskiy (CDISE)
- Calibration method and system (PCT/RU2015/000378) Kirsanov D., Panchuk V., Khaydukova M., Legin A. (STRIP)
- Superplastic Aluminium Alloy (Variants), Use Thereof And Product Made Therefrom (PCT/RU2015/000731) Mikhaylovskaya A., Kotov A., Portnoy V., Kishchik A., Kishchik M. (STRIP)
- A nanoelectrode for detecting cu(ii) ions and a method of producing and using thereof (PCT/RU2015/000958) Erofeev A., Gorelkin P., Majouga A., Usmanov A., Yaminsky I., Korchev Y. (STRIP)

Patent applications 2016 – 2018





Value Generation

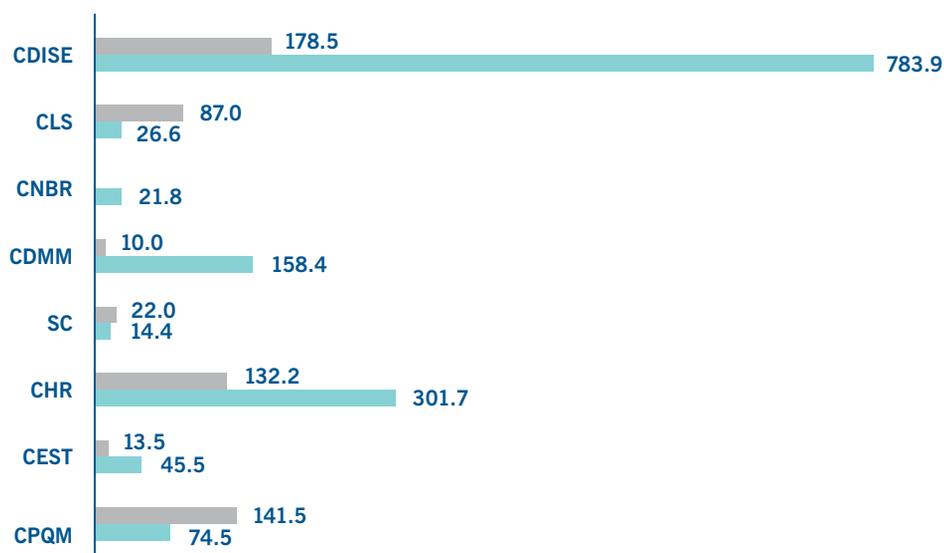
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Industry Funded Research

In comparison with the previous year, 2018 showed a double increase in the annual amount of funding under R&D contracts. The amount of work performed by the Institute totaled 857 mln Rub. The portfolio of CREIs contracts included 108 R&D projects covering a variety of specializations; among the contractors are Russian and international companies – Total E&P Recherche Developpement, Airbus SAS, Huawei, Gazprom Neft, Lukoil Engineering, Phillips Innovation Labs, National Technology Initiative, Russian Venture Company and others. New contracts were signed for 1,5 billion Rub, 1,4 bln Rub of which are secured for the period of 2019-2022. Among the completed projects are:

- Techniques developed by the Applied Information Theory group (CDISE) will be implemented in future wireless networks as well as fiber optics lines and cloud storage systems through cooperation with industrial partners, including **Huawei**.
- Advances in approaches to data analysis have been achieved by Scientific Computing; Advanced Data Analytics and Deep Learning Groups (CDISE) are being implemented by various companies including **Huawei**, **Yandex**, **Sberbank**, and **LG**.
- The project on the perforated honeycomb structure for space device construction successfully completed with **ROSCOSMOS** and **NPO PM MKB**. As a result, batches of 6-sided and flexible honeycomb structures of aluminum foil were created – led by Gennady Rudensky and Ighor Uzhinsky, Laboratory for Cyber-Physical Systems (CDMM).
- A project on cattle genotyping in Tatarstan in partnership with **Sustainable Food**
- **Systems Ireland, enterprise «Elita», Institute for Animal Husbandry (VIZh)** (led by Philipp Khaitovich, CNBR). In parallel, negotiations regarding the further expansion of genotyping with several major players in the industry are ongoing.
- A pilot project, “Digital Ship,” with the **Sredne-Nevskiy Shipyard**, involving the creation of a platform for monitoring the vessel life cycle and processes associated with its operation was implemented by a joint team of IoT Center (Dmitry Lakontsev, Serafim Novichkov) and CPQM (Arkady Shipulin).
- Skoltech was awarded the title, “The Best Scientific Partner,” by **Gazprom Neft**. Research collaboration contracts with Gazprom Neft and other oil companies were expanded, focusing on applied research results and development of new technologies for exploration and production of hydrocarbons, including advanced modeling, artificial intelligence and materials design technologies. Among the highlights: the creation of new super-hard materials for drill bit cutters, advanced multiphase systems modeling technologies, AI-based digital reservoir models using machine learning methods, and advanced digital rock technologies.
- Projects with **Philips** on the detection of pathologies in radiological medical records to improve the methods of agnostic training in the analysis of medical images (led by Dmitry Dylov, CDISE).
- The establishment of the Center of Excellence, “Wireless Communications and Internet of Things,” in consortium with more than 50 industrial and academic partners (MIET, HSE, SUAI, SPBSTU, Huawei, Sberbank, Rosseti, Philips, Cherkisovo, Nordgold etc).

Portfolio of R&D contracts funding, mln rub



The chart presents a R&D contract portfolio, e.g. total amount of funds secured for the upcoming periods

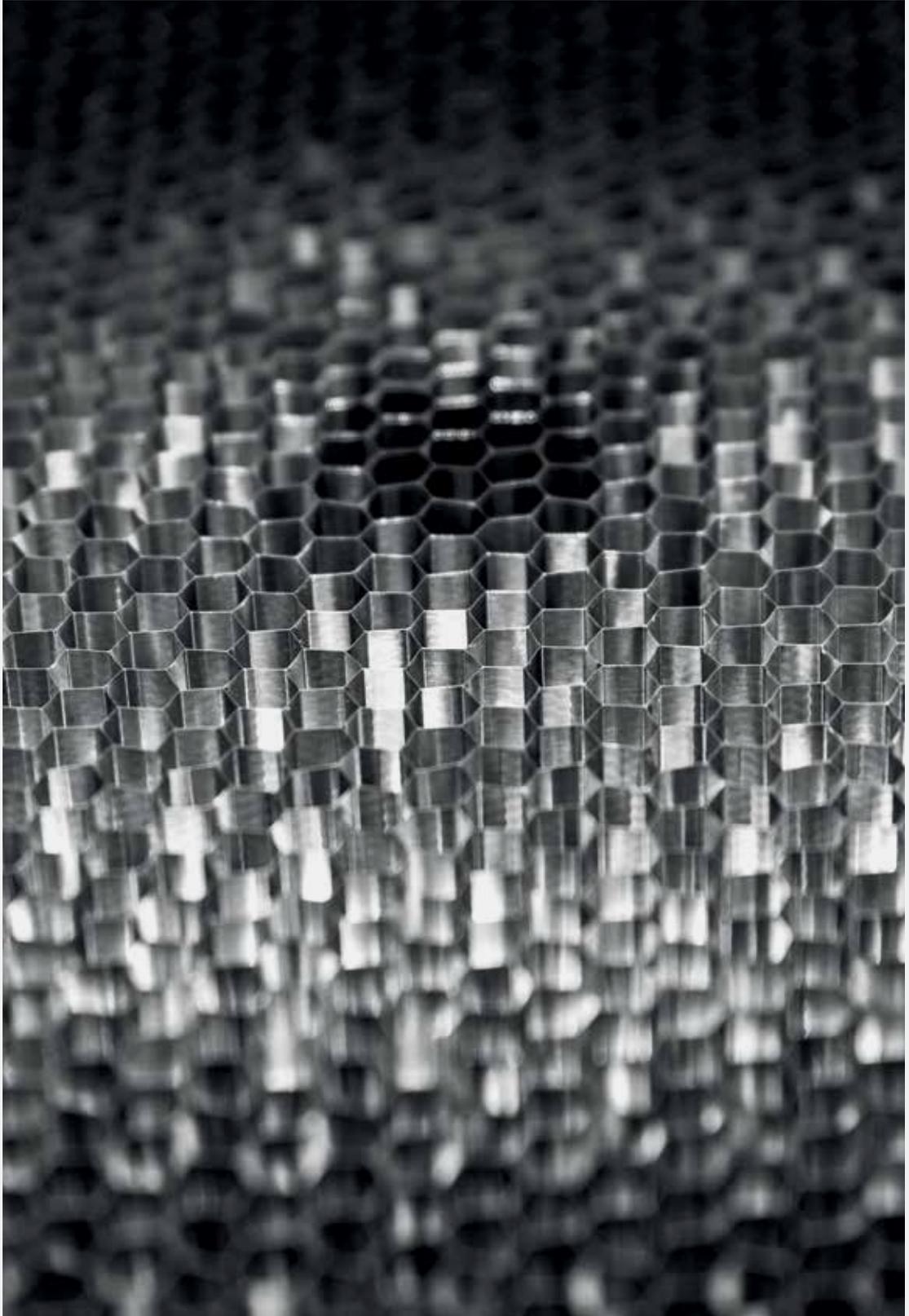
■ R&D contracts portfolio as of 1 Jan, 2018

■ R&D contracts portfolio as of March, 2019



ALEXEY PONOMAREV, Vice President for Industrial Cooperation:

“This year, we have achieved tangible results in various applied research projects that run a gamut, ranging from a manufacturing technology for spacecraft structures to a livestock genetic monitoring system. This is a good basis for moving on to more formidable challenges.”



// TRANSLATING SCIENCE INTO TECHNOLOGY

ALUMINUM FOIL FOR SPACE



The collaborative endeavor of Skoltech and Academician M.F. Reshetnev Information Satellite Systems (ISS-Reshetnev) has materialized in a new composite technology for manufacturing the aluminum foil honeycomb core. Honeycomb structures are widely used in the aerospace, shipbuilding, automotive, and consumer sectors.

The new product was developed under contract with Roscosmos State Corporation.

Used primarily in spacecraft structures, the aluminum foil honeycomb core is a high-strength lightweight composite material with 23 micron thick foil and a 2.5 mm long cell face.

Skoltech engineers developed unique equipment leveraging on the capabilities of laser and machine vision technology and cutting-edge automation solutions and were the first to propose and implement a novel adhesive strip positioning method ensuring

high-precision assembly and enhanced stress-strain performances.

High-accuracy sheet positioning in the honeycomb assembly was the project's key engineering challenge; the designers addressed this using machine vision technologies and high-speed video processing algorithms developed at Skoltech.

The aluminum honeycomb core is an indispensable element in high-specific-strength structures that should withstand large loads while having the lowest possible weight. These are in high demand in a variety of sectors, particularly in the space industry where the costs increase manifold with every extra kilogram.

In October 2018, an aluminum-honeycomb core production line was launched at NPO PM Small Design Bureau, which makes part of ISS-Reshetnev. This unique and complex facility, unrivaled in Russia, was built from scratch and tested within the space of a year.

New Enterprises & Technology Licensing

At the end of December 2018, Skoltech had established 43 start-ups (since 2013) from faculty, researchers, students and alumni; of these companies, 26 companies have an established Skolkovo residency. Several start-ups have received international recognition. The total income generated from Skoltech start-ups in 2018 reached more than 100 mln Rub. Of this figure, the start-up, “Rustor,” generated 15 mln Rub, Cyber Academy – 30 mln Rub, and Inspector Cloud - more than 40 mln Rub.

At one of Russia’s most prestigious start-up events, known as “Accelerator of Sberbank and 500 Startups,” Skoltech start-ups performed very well and had the largest share of entries as finalists (10%) at this countrywide competition; the selection process began during Q3, 2018. The Skoltech companies chosen as finalists were ProctorEdu LLC, Shipitto, Zenome and InspectorCloud.

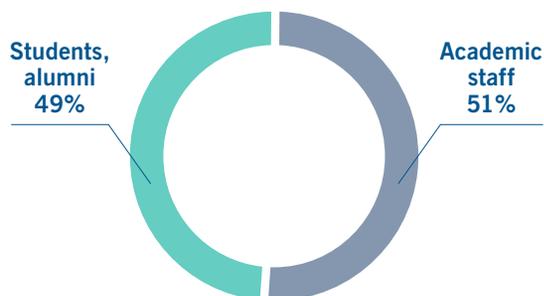
During the course of the year, individual Skoltech entrepreneurs were also recognized with distinction outside Russia. Hripsime Matevosyan, a former Skoltech PhD student, was named among Forbes USA, “30 under 30: manufacturing & industry.” Matevosyan co-founded Swiftera, a high-altitude imaging company that uses a floating camera that reaches altitudes higher than drones can but below those of satellites. Her company has

raised seed funding from Draper Associates and is selling its geospatial data to architects, municipalities and others. Nataliya Glazkova, founder of Cardiolog, was given a special award of appreciation by the President of Armenia during a start-up competition challenge.

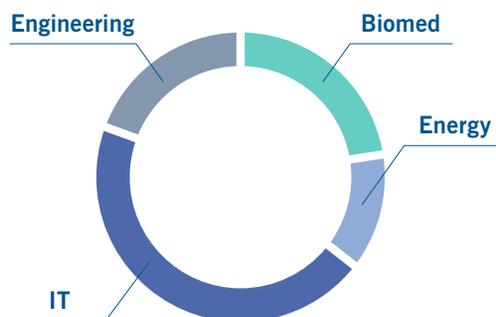
Start-up activity at-a-glance:

- **ProctorEdu LLC (Adeny Adebayo** (Class of 2016) and **Inspector Cloud** (Pavel Boyko) were selected by international startup accelerator 500Startups and Sberbank for a joint accelerator at the end of an initial review stage. Each of the selected teams will receive investments in the form of a convertible loan of up to 10 million rubles, and the seven best companies will go to Silicon Valley for acceleration in 2019.
- **SENSE2BEAT** was selected as a distinguished start-up at the Samsung Connection Day in Moscow; its founder was rated among 10 young innovators from around the world at the Wish Summit held in Qatar. It also came 3rd place out of over 125 entrees at the Sevan Start-up Summit (Armenia) in July and selected for the IDTechEx Launchpad, with the opportunity to showcase prototypes and demonstrations of their new products.

Enterprises by founders



Enterprises by Skolkovo clusters



Enterprises established by Skoltech faculty, researchers, students & alumni (cumulative from 2013)



Several Skolkovo startups are collaborating with Skoltech in terms of using the institute’s resources – space for rent, help with legal/accounting operations, IP support (owned by Skoltech or jointly) in order to license it to a startup further on, and a startup’s access to

equipment where possible. Among the partners are – “Геро” (Gero), “Реал Таргет” (Real Target), “ЛП ТЕХНОЛОГИИ” (LP Technologies), “Клайбер бионикс” (Clyber Bionics); the majority of the the majority of companies collaborated within the Cobrain Center.

Technology Licensing

The highlight of the year was Skoltech's entering into a joint invention administration agreement with the Broad Institute (MIT), and Harvard and Rutgers University to make jointly developed intellectual property related to CRISPR systems. The IP, also co-owned by Harvard and MIT, relates to CRISPR systems referred to as C2c1 (Cas12b) and C2c2 (Cas13). Beginning in 2015, a team of collaborators announced

the discovery and characterization of these CRISPR systems. This international cooperative effort has strengthened the understanding and availability of CRISPR biological science. In particular, the CRISPR C2c2 system provides an important addition to the suite of molecular biology tools, allowing for the targeting of RNA, which helps with crucial steps in protein synthesis, for example.

Two licensing agreements were signed (CDISE):

- **Non-Exclusive License Agreement for Software MARIE++** Interactions modelling of electromagnetic waves with biological tissues in next-generation MRI systems.

Authors: A. Polimeridis, M. Litsarev, G. Guriev, I. Georgakis
Licensed to the international company: Qbio, Inc., USA

- **Exclusive License Agreement for Software ERA-GLONASS. The program is designed**

to perform functional testing of the ERA-GLONASS emergency call devices and it is a GSM base station emulator, a GSM core emulator (MSC/HLR), a voice SIP server, an SMS message processing server and emulator of the server for receiving and processing of the Minimum Data Set (MND) from the UEEP – PSAP (Public-Safety Answering Point).

Authors: D. Lakontsev, S. Novichkov, A. Ivanov
Licensed to Russian company: NOVYE INZHENERNYE TEKHNologii, LLC



Natalia Glazkova – CEO of the Sense2beat project, winner of the summer competition “Sevan Startup Summit 2018” received the special prize of the President of Armenia Armen Sarkissian



ISSI ROZEN, *chief business officer of the Broad Institute:*

“This technology represents a transformative opportunity to improve human health. We are proud to partner with Skoltech and many other collaborating institutions to share these tools openly.”

Professional Training

The activities on professional training programs started in 2018 with defining key areas of the product portfolio. About 60 courses covering artificial intelligence, data science, hydrocarbon recovery, additive technologies, composite materials, systems engineering, and PLM were identified for promotion on the professional education market.

The courses were delivered to high-tech companies and institutes of development. Among the clients were: Gazprom Neft, Russian Railways, Bitfury, Novartis, Boeing Russia, Titan Avangard, VNIINEft (Zarubezhneft), Sberbank, Rostelekom, Libelium, University 2035, and Moscow Business School. Select examples of courses and seminars delivered:

- Machine Learning (CDISE) for Sberbank,
- Artificial Intelligence (CDISE) for Central Bank of the Russian Federation,
- Technology Block Chain (CDISE) for Corporate University of Russian Railways,
- Sensors and Embedded systems for Internet of Things (CDISE) for Gazprom Neft,
- Fundamental scientific principles of genome editing (CLS) for Novartis Pharma &

- Pharm-Sintez,
- Introduction to Additive Manufacturing Technologies (CDMM),
- Intelligent Systems for Electrical Heating Energy Consumption Management (CEST) for representatives of energy industry companies.

A special landing page on available courses was launched on the Skoltech website. The first B2C marketing campaign resulted in enrolling attendees for five courses.

In 2018, Skoltech also established collaboration with the Russian Federation Ministry of Health. Within the framework of collaboration, Skoltech (Supporting Skoltech Center – Center for Open Learning) developed 80 modules for obligatory additional medical education for clinical doctors and pharmacists. Although medical competencies aren't within its core expertise, Skoltech introduced modern medical data analyses into routing healthcare practices. Programs were created for the Ministry portal for continuous medical education in partnership with the Russian Federal Research Center for Medical Genetics and N.N. Blokhin National Medical Research Center of Oncology.



ALEXEY LYAKIN, *Vice President and Director of Sberbank's Treasury:*

“The ability to embed technology in the bank management and business processes is the key to staying fully operational and competitive over the five-year horizon and beyond. There is an apparent need to implement blockchain technology in transactions, biometrics in client identification and machine learning methods; this includes neural networks and surrogate modeling, to facilitate customer relations and optimize internal decision-making with regard to the impact of the rapidly changing market and macro-economic environment on the bank's profits and risks. Decision-making already benefits from an impact assessment process based on machine learning models.”

//SKOLTECH & SBERBANK

SKOLTECH COURSE FOR SBERBANK CORPORATE UNIVERSITY



Skoltech's course, tailored for Sberbank, covers data analysis and machine learning. The course is 40 academic hours and covers 5 topics with four lectures and four workshops. The average group size is 20 participants.

The lectures focus on various mathematics-related topics. The curriculum also includes a lecture on recommender systems.

Advisory Services

Development of analytical materials and policy briefs on science, technology & innovation

- White Book “Internet of Things: Promising Markets and Technologies”
- Materials on strategy for development of radio electronic and electronic industries in Russia and telecom market (including perspectives for photonics applications and 5G network deployment)
- Technological review on multi-beam electron lithography

Analytical support to development of strategies, programs, standards in science & technology development

- Participation in road mapping for AeroNet, SpaceNet, TechNet (NTI working groups)
- Participation in R&D initiatives in energy storage (NTI e-mobility project)
- Participation in work for improving the concept and plan for the International Scientific-Technological Cooperation developed by the Ministry of Science and Higher Education
- Proposals on the Digital Economy Program (Federal project, “Regulatory Framework” and “Digital Technologies”)

Advising and analytical research for governmental bodies, institutes for development

- First BRICS Working Group on photonics (Ministry of Science and Higher Education) defining priority areas for collaboration within Joint Calls, 2019,
- Addressing queries from the governmental bodies, including suggestions on mechanisms of open access to platforms to be used by research organizations and high-tech companies; amendments to the concept of development of standards in the RF; proposals to the Ministry of Economic Development on the creation and functioning of technology transfer centers; proposals on technical requirements to the Roadmap for Development of cross-sectorial key enabling digital technologies
- Report on prospects for usage of domestic telecom equipment (presented at a working meeting chaired by the Deputy Prime Minister, M.A. Akimov)
- Analytical support to the Skolkovo Foundation (potential markets for professional development training, current state of online learning in the area of professional education, potential markets for advisory services)

Advisory services for high tech companies

- scientific and technological expertise for Lukoil, Zarubezhneft, SuperOks, Agrogenetika, and “Systems MFM”
- consulting services to VneshEkonomBank (VEB) on investing to space telecommunications infrastructure
 - consulting to URALCHEM – analytics on soil phosphorus-solubilizing microorganisms
- Technology audit of Mapper LLC, Netherlands (Rusnano portfolio company) was performed for Rusnano. Results of the report led to global strategic decisions and considerable budget saving
- Advisory to Vnesheconombank (VEB) on Energy and Space projects

Skoltech is presented in a range of governmental boards, advisory groups and R&D councils of high-tech companies:

- Council on Science and Education under the President of the Russian Federation,
- Economics Council under the President of the Russian Federation,
- Commission on Technological Development of Russia's Economy under the President of the Russian Federation,
- Russian Federation Board on prioritization of research and technological directions in the oil and gas industry,
- Board of the Digital Economy Program,
- Working group "Standardization" of the Digital Economy Program,
- Working Group on cyber-physical systems in Rosstandart.

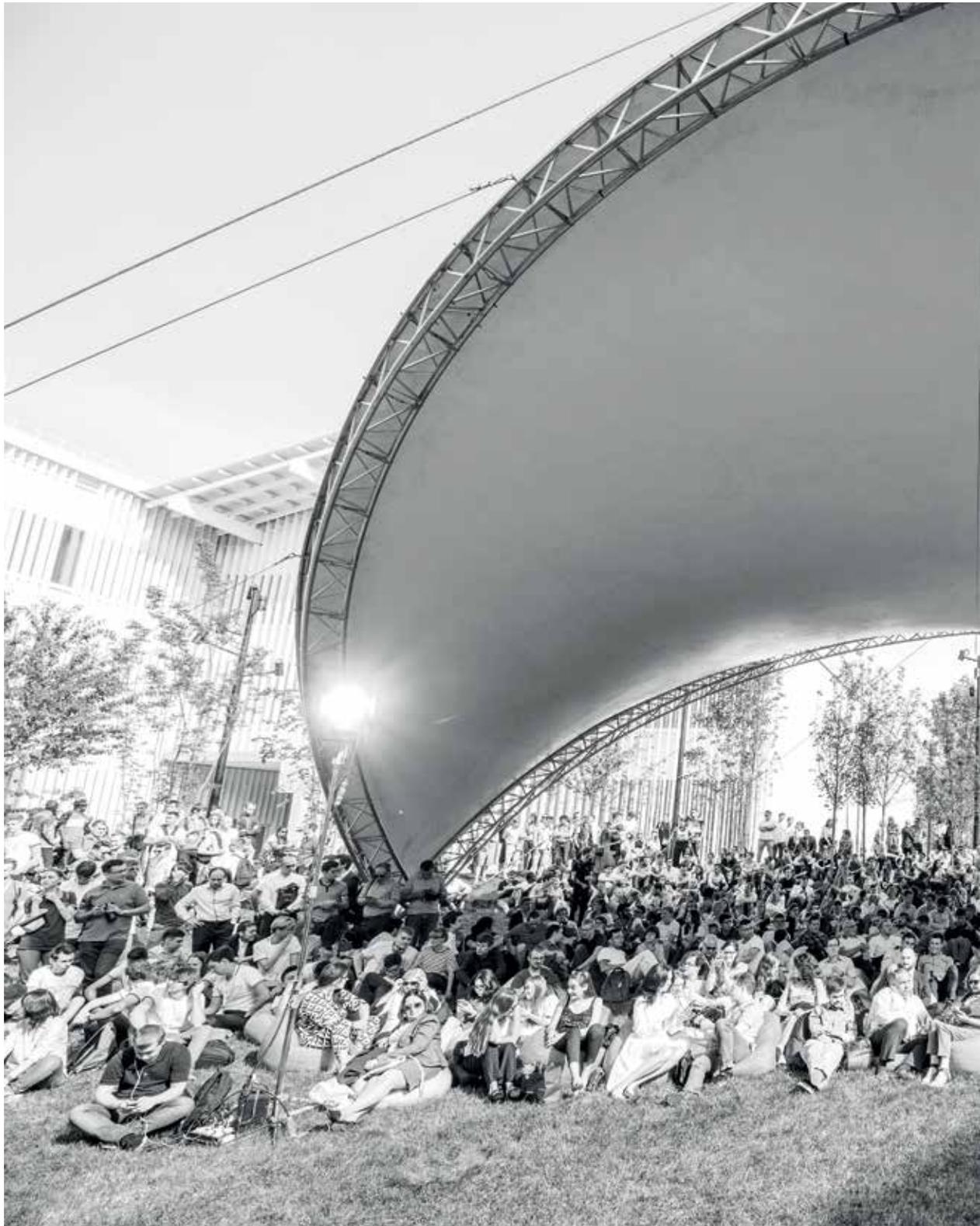


Meeting of the 1st BRICS Working Group on Photonics (March, 2018)



Campus

/04





Opening of Skoltech's new campus took place on September 1, 2018

Campus

The new campus was partially opened in October 2018 with enough space to begin teaching activities for about 400 students, office space for roughly 120 staff, and seminar/conference space for 500+ guests with a seating capacity of 250. The remainder of teaching and learning spaces, cohort/project-based space, seminar and conference rooms, and office space will be opened during Q1 2019.

Building engineering systems are installed and operating manually while automation systems testing and commissioning is being completed. In accordance with schedules confirmed by the Foundation/ODPS, building automation will be completed and delivered in Q1 2019.

Logistics and chemical storage facilities were under construction and planned for delivery in Q1 2019. For the time being, Skoltech continues to use TPOC-3 as the primary delivery and distribution point for all incoming materials required for the institute's operations.

Dining and kitchen facilities also remain under construction with expected delivery at the end of Q1 2019; a food service operator has been selected. Over the course of 2019, as this process reaches a critical point, other amenities such as cafes, a bookstore, banking machines and a restaurant will be opened.

Relocation commenced in October of 2018. As of the end of 2018, a total of 120 staff members were relocated, and just under 400

students were attending lectures on a regular basis. CDMM academic personnel were set up in their new space, and preparatory works required to relocate CDMM labs commenced and will be complete by the end of Q1 2019.

The Advanced Imaging and Masterskaya facilities have also commenced relocation activities. The Masterskaya facilities will be in place by the end of February 2019, and the Advanced Imaging facilities by the end of March 2019.

The remaining administrative staff and some faculty will be relocated to the new building by the end of Q1 2019. As institute facilities are relocated to the new campus, we continue to consolidate faculty and staff into TPOC-3, and free up space in TPOC-4 in accordance with both approved relocation schedules and the institute's budget.

The lab/research facilities design and construction program continues to move according to schedule and will be completed by the end of 2021.

Skoltech's new campus is located just east of the Technopark, and across from the Matreshka and Hypercube buildings, adjacent to future playing fields and a sports complex, which is currently under development by the Foundation. More than just a technology and research park, the Skolkovo Innovation Center is a complete work/study/living environment; it offers world-class facilities for living, research, business and socializing, with a rich and comfortable urban environment.



Prime Minister of the Russian Federation Dmitry Medvedev visited Skoltech's new campus

Operational Management

105

The Operational Management Block provides the institute with a variety of services, including financial planning and controlling, accounting, human resources management, IT and legal support, procurement, internal control, and safety. Among the major activities of the year:

- implementation of International Financial Reporting Standards (IFRS),
- completed audit made by the Skolkovo Foundation (KPMG) for target use of the Foundation Grant; audit according to IFRS and Russian accounting standards (unqualified (positive) opinion received)
- legal support on the institute's activities, support on establishing Skoltech enterprises,
- procurement routine implemented to ensure value for money,
- archive solution (digital and hard-copy) implemented,
- migration to a new travel provider completed,
- reengineering of business processes completed, the new ERP (Microsoft Dynamics AX 2012 R3) launched;
- internal controls, addressing risks and precisely described in Risk Control Matrices, are being embedded into business processes during implementation of the ERP and further integration with IT infrastructure
- online reporting and automated budget transfer system (EPS Cognos) implemented;
- Directum (EDMS) launched
- Student Information System (SIS) project launched
- Service Level Agreement launched in a number of services,
- project for Information Security Management launched to mitigate cyber security risks and ensure legal compliance with the Federal Law "On Personal Data"
- approach for warehousing developed (to be implemented in 2019).



TATYANA ZAKHAROVA, *Vice President for Finance & Operations:*

"We are constantly working on improving operational activities and are aimed at optimization and automatization of business processes at all levels. On-line reporting and automated budget transfer system has been successfully implemented, the new ERP system has been developed for further implementation."

GLOSSARY

GRANT AGREEMENT

Agreement between the Institute and Non-commercial organization “Foundation for Development of the Center for Elaboration and Commercialization of New Technologies” (Skolkovo Foundation)

CAS

Center for Advanced Studies

CDIBB

Center for Data-Intensive Biomedicine & Biotechnology

CDISE

Center for Computational Data-Intensive Science and Engineering

CDMM

Center for Design, Manufacturing and Materials

CEE

Center for Electrorchemical Energy Storage

CEI

Center for Entrepreneurship and Innovation

CES

Center for Energy Systems

CEST

Center for Energy Science and Technology

CHR

Center for Hydrocarbon Recovery

CLS

Center for Life Sciences

CNBR

Center for Neurobiology and Brain Restoration

CTB

Center for Translational Biomedicine

CPQM

Center for Photonics and Quantum Materials

CREI (CENTER)

Institute’s structural unit implementing a long-term (at least three years) development program, aimed at integration of research and education activities, value generation (Centers for Research, Education and Innovation (CREIs), Center for Advanced Studies)

GCF

Genomics Core Facility

SKOLKOVO FOUNDATION

Non-Commercial Organization “Foundation for Development of the Center for Elaboration and Commercialization of New Technologies”

KPI

Key performance indicator of the Institute’s development

LEARNING COMMONS

special campus spaces that integrate computing and library services, makerspaces, equipment, tools, shared for tutoring, reading, team-work, aimed at stimulating active learning (available 24/7)

RFBR

Russian Foundation for Basic Research

RSF

Russian Science Foundation

SC

Space Center

SKOLTECH, INSTITUTE

Autonomous Non-Profit Organization for Higher Education “Skolkovo Institute of Science and Technology”

STRATEGIC ACTION PLAN (SAP)

Institutional Plan for Development which sets vision, strategic goals and initiatives, KPIs, tasks and actions, responsibilities, budget. The SAP is developed for a three years’ cycle, annually updated and approved by the Board of Trustees. The SAP serves a basis for the Grant Agreement, reporting to the stakeholders

STRATEGIC KPI

Institutional key performance indicator, established in the subprogram and/or grant agreement

SUBPROGRAM

Subprogram “Establishment and Development of the Skolkovo Innovation Center” in the frames of the State Program of the Russian Federation “Economic Development and Innovative Economy”

TARGET DOMAIN

Strategic focus area of the Institute’s education, scientific, research and development and (or) innovation activities. Approved by the Board of Trustees within the SAP.

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