RUSSIAN MAECENAS

November 2017 SOCIAL PARTNERSHIP MAGAZINE *Issue 7/26*

With Russian pages

Fair Government
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RUSSIAN MAECENAS

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Publisher: St Petersburg Social Organization
'Journalist Centre of International Co-operation'
Address: 5 Universitetskaya nab, flat 212, 199034,
St. Petersburg. Tel./Fax +7 (812) 328 2012.

Distributed to the leaders of government agencies, companies, cultural institutions, and charities.

The Magazine is registered with the Federal Agency for the Supervision of Conformity with the Legislation in the Sphere of Mass Media and the Preservation of Cultural Heritage.
Registration certificate: PI No. FS2–8864 from 01.11.2007. Issue submitted to publisher 30.11.2017. Printed at 'Premium Press', 4 Optikov St. 197374, St. Petersburg.
Circulation: 1500 copies.

Cover images:
St. Petersburg. Sculptures on the Colonnade of St. Isaac's Cathedral.
Photo: Alexander Petrosian

Inspiration in Scarlet. Joint project between the State Museum of the History of St. Petersburg and the LILIA KISSELENKO Fashion House
Photo: Alexander Cherviakov

The articles in the 'Investment in Intellect' section (p. 4–33) are supported by a St. Petersburg grant

Welcome!

Sweet as a NET in 2035

As we look into the future, we can say an unequivocal DA (YES) to the English NET (the Russian word for NO). The key markets in 2035 on which the National Technological Initiative (NTI) is aimed will definitely be net-based. This year the prototype of an all-embracing public transport control system — part of the *Smart City* programme — was tested in St. Petersburg. The purpose is to link everyone working in the city's gigantic transport system through information networks and to obtain exhaustive information concerning its parameters — from the fuel consumption of a specific trolleybus to the number of fare-dodgers travelling in it. A further adjustment will be made by 2035: all public transport vehicles will be controlled by remote or onboard robots.

This vision of the future on a national and international scale is characteristic of various NTI projects and, most importantly, includes a humanitarian element, and not just as an afterthought. This was confirmed by a number of *Neuronet* events held in St. Petersburg in November. *Neuroforum* at the co-working centre *Boiling Point* featured demonstrations of how the *Neurochat* social network can be used for communicating with patients who have suffered a stroke on the basis of a *brain-computer* interface. At the Lumiere Hall the Industrial Association *Neuronet* staged a *Neurothlon* — disabled athletes (!) armed with assistive technologies competed in four disciplines, including controlling the characters in a computer game by power of thought. In parallel the ITMO University's *Neu-Theatre* interpreted the range of emotions of dancers with fonts on their heads into a language of figurative and colour fantasies.

It is no coincidence that St. Petersburg director Boris Pavlovich's horizontal theatre concept was included in the December programme of the NET Festival. It features plays which open up the space of the auditorium and the stage in order to make contact with those on the periphery of social life.

New technologies, which are the subject of the *Investment in Intellect* section of this issue, only make sense if they will help us to remain people in 2035 and beyond.

Arkady Sosnov,
Editor-in-Chief
of Russian Maecenas

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Maxim MEIKSIN, Chairman of the St. Petersburg Committee on Industrial Policy and Innovations / p. 30

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'FOR THE COMMON GOOD'
Businessman Sergey Gutsait has founded the Gorchakov Memorial School under the banner of the Pushkin Lyceum

Photo: Larisa Tiktinskaya

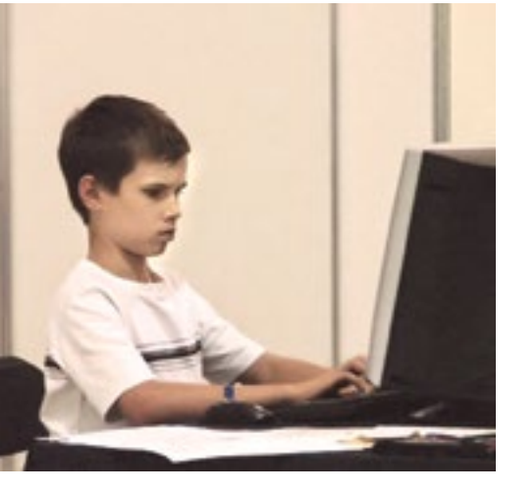
A CARILLON OVER THE CITY
The Belgian musician and composer Jo Haazen has revived a tradition established by Peter the Great

Photo: the St. Petersburg State University Press Office

A Flexible Schedule

THE UNIVERSITY OF INFORMATION TECHNOLOGY, MECHANICS AND OPTICS GIVES FREE REIN TO COMPUTER TALENTS

Arkady SOSNOV. Photos: Timur Turgunov, the ITMO University Archive, G. Korotkevich's personal archive



Gena Korotkevich. 2006.

CONVERSATIONS AS A WORKOUT

Almost everything written about Gennady Korotkevich in the Russian version of Wikipedia is correct. At the age of 23 he has won many international programming competitions under the auspices of Google, IBM, Facebook, VKontakte, Yandex, the Mail.Ru group and the world leader in the ratings CodeForces. Gennady, though, prefers the entry in the English Wikipedia — it is shorter and more accurate, which suits his pedantic character.

For example, according to the Russian Wikipedia he gave his medals to the Museum of Byelorussian Statehood. 'I have given some of them, but not all', elaborates the champion, 'just the three gold medals I won in computer science olympiads at school'. He has taken some of the trophies from his student years home to Gomel and keeps some in St. Petersburg. He now has so many medals that it is time to compile an inventory.

He solved his first problem at the age of eight, which was when he chose the nickname *tourist* by which he is known in the programming community — it was the trademark of his skis as a child, and he began writing programs in junior school. In his third year at school (including the zero grade) he won a prize at the Belarus School Olympiad. Since then journalists' interest in him has not abated, nor has Gena's desire to avoid contact with them. It is because 'not only do they print lies, but even those of your colleagues who promise to send me their text in advance don't do it'. The undertaking 'I'll definitely send it' has become meaningless.

He was particularly annoyed by a version that his father (Gennady's parents are also programmers) had invented an educational computer game for him. He did not actually invent a game, but he did help him. Journalists delighted in reporting that

The articles are supported by a St. Petersburg grant

he had jumped straight from the second class to the fourth, but that was also untrue — it was just that all the classes had been renumbered during the reform of schools.

In the interest of fairness: this unique lad never leaves journalists in peace! Incredible as it may seem, he won gold medals for six years running at international school olympiads (International Olympiads in Informatics), becoming absolute champion on three occasions, and was given the unofficial title of the Byelorussian genius. It is amusing that Korotkevich is still called a wunderkind, as though he were still a child. While a student at the ITMO University in St. Petersburg he has twice been world champion as part of a team at ACM ICPC (Association for Computing Machinery International Collegiate Programming Contests) — in 2013, his first year at university, and in 2015. Why only twice? Because under the rules of these competitions nobody can compete in them more than twice!

In the intervening year (2014) *tourist* won the Great Programmer's Helmet after winning the world's five major professional competitions. His comment: 'It can't happen year after year. I was just lucky to a certain extent at that time'. But the pace did not slacken after that: he won six tournaments in 2016, including the prestigious Google Code Jam for the third time running, for which he earned $15,000.

Why did he miss the ACM ICPC in 2014 (the ITMO team did not win it without him)? Did he take a break to study? Did he go in pursuit of prizes at professional tournaments? Was there any conflict with the team? This was just one of the subjects I wanted to clarify...

Such personnel are in great demand in the economy. Global corporations entice them with conceivable and inconceivable benefits (for instance, IBM take on members of prizewinning teams without interview). Russian Minister of Defence Sergey Shoigu invites them to join the armed forces to reinforce the country's military power with the aid of IT. The university hopes to keep them — let them study science, create start-up businesses or train future champion programmers, like the celebrated trainers Andrey Stankevich at ITMO and Andrey Lopatin at St. Petersburg State University.

At the International and All-Russian Schools Olympiads. 2007.

'Our lads are in demand at the cutting edge of algorithmic programming which, along with mathematics, is the basic technology of the near future, particularly systems of artificial intellect', says Andrey Lopatin. 'Even those who have not won medals are very adept at creating innovative products. As for the champions, IT companies are prepared to fight among themselves for them'.

'A university graduate who has faced the heat of working as a team in competitions and in training finishes all that at the age of 21–22, and his only problem then is how to choose the best from all his numerous offers of employment', confirms Professor Vladimir Parfionov, Dean of the Faculty of Information Technology and Programming at ITMO.

'There were no regular lessons or special systems of learning. My son worked independently and we tried to help him — mainly to guide him to think correctly and explain anything that was difficult. Sometimes it was not easy to explain, but we tried to find a way. That actually applies not only to programming: if a child asks why it is dark at night and cold in winter, you have to take a table lamp and an apple and explain. But Gena's principal trainer was undoubtedly Gena himself'.

Vladimir KOROTKEVICH,
Candidate of Technical Sciences,
Assistant Professor in the Department of Mathematical Problems of Management and Information Science at Francisk Skorina State University in Gomel

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Visiting the journalists.
Seated at the table (left to right):
Andrey Stankevich, Vladimir Parfionov,
Andrey Lopatin, Lidia Perovskaya.

According to authoritative experts, with the development of digital technologies many popular professions and whole spheres of activity will die out. In particular, low-paid work in copying programs will be replaced by mechanical algorithms (the mass reductions in lowly-qualified programmers which have begun in India are the first sign of this trend), so the specialization of Russian software companies in creating high-end solutions will be in even greater demand on the international IT market.

Gena Korotkevich has not yet promised anything to anyone. He is in the second year of his master's degree course and doing what he likes. For example, he is in the university's *What? Where? When?* team captained by Andrey Stankevich (a sporting version, without the spinning top) and, believe it or not, has not yet decided on the subject of his dissertation. This decision has to be approached with respect: a world-beater is not obliged to meet our expectations. Nevertheless, even his supervisors who know him well are distressed by his unpredictability.

'He is an intelligent, modest, well brought-up young man who doesn't know what he wants in life', grumbles Anatoly Shalyto, one of the leading specialists in automata-based programming, Professor in the Department of Computer Technology at ITMO and initiator of the Keep the Best in Universities programme (and Korotkevich & Co. are certainly the best).

CONVERSATIONS IN THE GARDEN

The 'intelligent, modest and unpredictable' lad was waiting for us at the entrance to the Botanical Garden. Not because he is a botanist (ha! ha!) — on the contrary, he likes football and table tennis, which he played as a child (his mother Lyudmila took him to a club) and now uses as the perfect game for developing psychological stability. We had simply chosen a convenient place for a conversation and photographs.

While we enjoyed the wonders of the vegetable world our thoughts were far removed from mathematics. Gennady looked at the citrus trees with curiosity, but quietly passed by the money tree — in fact, he dresses modestly, does not have a car (he has nowhere to go) and since his first year at university has lived in a student hostel not far from ITMO. He does not consider the hostel to be a place of temptations capable of distracting him from his studies and sees no necessity to find a flat of his own (though he has the wherewithal). He says: 'For some the hostel is too crowded, for some it is too noisy, but not for me. I obviously have modest accommodation requirements'.

Korotkevich shares a room with Artyom Vasiliev, a postgraduate who was also a member of the champion team in 2015. My suggestion that they talked about programming all evening was immediately repudiated: 'Sometimes we talk, but sometimes we sit in silence, each with his own laptop'. There, among the palms and lianas, it dawned on me: Gena is a *tourist*, which means he spends a lot of his time on the Internet where his pleasure gardens are, and he is probably not the same person there as he is in reality. In attempting to understand him this duality has to be borne in mind. I discovered that the websites he visits most frequently are VKontakte, CodeForces, Eurosport, Yandex and Google. Even there he cannot do without sport.

Somewhere between the Mexican cacti and the Vietnamese orchids Gena said that he does not attach particular importance

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Investment in Intellect

to world ratings. His first place is largely a coincidence. It is just like the world's top tennis players — if they win a tournament they confirm their status, if they lose they go down a few places, but can get them back. He was first included in the international ratings in 2006 before he was 12 years old, and knows how changeable the ratings are at the top. The two best-known websites, who compile their own ratings on the basis of their own competitions, in person and by correspondence, are TopCoder and the recently popular CodeForces.

At the time of our 'botanical' meeting in the winter of 2017 TopCoder, the organizer of the World Individual Programming Championships, had Korotkevich in third place, while CodeForces placed him first. On CodeForces, which was developed in Russia, Gena is introduced as the Legendary Grand Master (a title awarded for the achievement of a specific — very high — rating). He has nearly 11,000 friends on the website. (In autumn, when editing this paragraph, I glanced at CodeForces and saw that the *tourist* was still first by a comfortable margin, while in the *last visit* column it showed *now online*. So we had met up again, this time virtually).

In Korotkevich's blog on the same website you can find an entry from five years back: an invitation to visitors to the website to take part in competitions: 'Original tasks have been invented for you by *tourist* and *Romka*. We have tried to emphasize the conceptual element, so we hope that you will have to think longer than just choosing a code'.

This programmers' humour has to be deciphered. Behind the apparently simple wish to 'think longer than just choosing a code' lies a profound meaning with far-reaching consequences. It fully blends into the persona of the Russian programmer who — unlike his Indian counterpart, for example — adores non-standard creative tasks.

'Solving a task is a process that consists of two basic phases', explained Gennady, standing by a wild agave. 'After reading the conditions you have first to invent a solution algorithm, then write a program which will accomplish what is prescribed by the algorithm. Tasks, roughly speaking, are divided into two types: in some you have to ponder over the solution for a very long time and the code will be quite short — the simpler the algorithm the more difficult it is to find; in the second type it is the other way round — the idea of the solution is as clear as day, but the algorithm requires a great deal of work, so you write a lot and in great detail. That doesn't mean that such technical tasks don't require you to engage your brain. You can find a simple way of turning the algorithm of the solution into a code — the program will be shorter and the likelihood of a mistake will be less'.

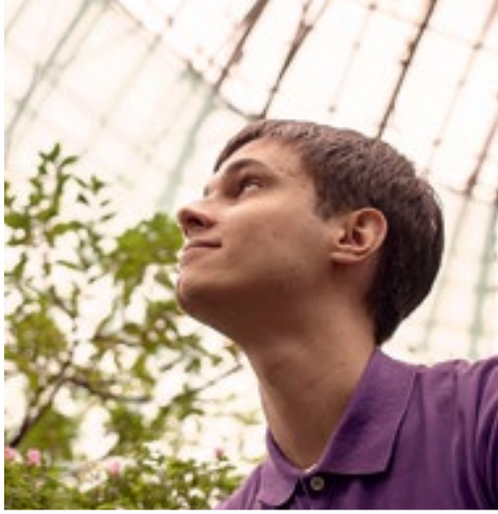
Gena is still composing and selecting tasks: he did this as a member of the jury at the quarter-finals and semi-finals of the 2017 World Championships. This is how he explains the attraction of composition: 'When you solve a lot of tasks you think of ideas that have not yet been tried and have the desire to share them with other participants'. The Legendary Grand Master is clearly not an individualist as he regularly takes part in team competitions (though more frequently in individual ones).

'The combined creativity in team competitions is interesting. When you compete alone you may see a problem and not know what to do with it — sometimes you fall into a stupor, whereas in a team the lads all look at the problem from different angles'.

'But perhaps somebody drags their feet and that could be an irritation'.

'Perhaps I also drag my feet', he countered. 'I can't remember ever getting angry with teammates. Obviously the higher their standard the more enjoyable it is to compete together. And everyone at ITMO is of a high standard! Even if someone has a problem, part of the essence of teamwork is to sense this and redistribute the responsibility'.

Now here is an interesting detail: in 2014, when Korotkevich missed the ACM ICPC, he competed in some team tournaments as



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It is typical that football in Russia, despite the regular failures of the national team, is considered to be the Number One sport, whereas the exploits of our student programmers, who have won twelve world championships since 2000, outperforming the much-vaunted Harvards and Yales and holding off the Chinese dragon, are just ordinary people who are of no interest. Our football clubs employ foreign managers, but these lads hold training sessions all over the world. And if Spain is proud of its star-studded football, what is to stop us making programming our national sport, highlighting the drama of intellectual battles, producing beautiful TV pictures and finally becoming familiar with this area of excellence? All that prevents this, as far as I can see, is the modesty and decency of our computer geniuses...

an individual! And won! The point is that a team of three has one computer and a total of fifteen man-hours for thinking, whereas a lone competitor has only five hours, though the computer for writing the programme is fully at his disposal — an excellent opportunity to test his ability to 'toil' for three.

Later I tried to elicit from Andrey Stankevich, who has trained champion teams at ITMO for many years, what the brilliance of the modest Gena consists of. What his answer amounted to was that Gena is an absolute all-rounder with no weak points — he copes with tasks of both types just as easily! Since programming is an extension of real life, in which we are always finding solutions to tasks in our own way, I suggest readers measure this description against themselves:

'Gennady can solve any problem in his head and, having solved it, write it down — a unique combination of qualities that enables him to dominate. There are lots of clever lads among the olympiad competitors, including mathematicians who can solve any problem, but they encounter difficulties with realization (writing a code is hard). There are very good programmers who can codify various algorithms quickly and elegantly, but they cannot penetrate to the depth of the task or combine things that are known to them in order to find the solution. There are 'star pupils' who think well, programme well and after years of persistent training are successful at championships. And then there is the case of Gena Korotkevich, who can think of virtually any solution and programme it very quickly and without mistakes'.

Stankevich told me quite a bit more about his protégé. And I finished my conversation with the master of codes and algorithms in the Botanical Gardens cafe. My final question was: what for him was more important — to beat his rivals or to solve a problem without confining himself to the allotted time?

'The Olympic principle that taking part is more important than winning still applies, but it all depends on the situation. In the training process it is more important to solve a problem in order to learn something new, but when I am competing I put maximum effort into winning, whether in programming, football or table tennis'.

'You're a sportsman!'

'Yes, I suppose I am. The exception is intellectual games like What? Where? When? — for me that is not a sport but a means of adding to erudition, developing logic of thought and, of course, having fun in good company'.

The company, it turns out, are all familiar faces: the former competitors and current managers at programming championships play one evening a week. The 'cognoscenti' from ITMO, ridiculous as it may seem, are currently in 286th place, but have no complexes about that. Gennady admitted that he personally (only he?) did not have sufficient knowledge in humanities and his native wit was of no help. Some teams deliberately include historians and linguists, but the technical group led by Assistant Professor Stankevich believe in their own strengths...

Bidding a polite farewell the *tourist* went off, probably to the hostel and his laptop. The question of what he wants in life remained open.

But it made me think that St. Petersburg is famous not only for the Hermitage, White Nights and this Apothecary's Garden of Peter's that is now the Botanical Garden. Another phenomenon has blossomed before our very eyes — St. Petersburg has raised six two-time world programming champions (more than any other city): besides Korotkevich, Andrey Lopatin and Nikolay Durov from St. Petersburg State University and Evgeny Kapun, Mikhail Kever and Niyaz Nigmatullin from ITMO. There are also more than twenty one-time world champions.

Do we know much about these lads? Do we often see them on TV? After all, they, unlike the familiar characters on the box, are our national elite. Some people may have heard that Lopatin

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and Durov were the main developers of the VKontakte social network, one of the fastest in the world. Or that Alexander Shtuchkin, Evegeny Yuzhakov and Timofey Borodin, graduates of ITMO who have been successful in programming championships, founded Skartel, the company where the world's first WiMax communicator was developed... This generation will fight for the country's technological independence in tomorrow's digital world.

Generally speaking, many areas of the Russian economy are stagnating, but the software industry is growing year by year. Innovations in the IT field are going through the roof. The major Internet companies Yandex and the Mail.Ru Group were founded from scratch, without state support, with capital on the level of the Magnit chain of shops (but in the buying and selling sphere the share of intellect will be less). The major Russian raw materials companies are the result of the division of the Soviet legacy — nobody has started such a company from scratch in the last twenty years. So who is our national treasure?

If we compare the ITMO dynasty with Barcelona and their perennial rivals from St. Petersburg State University with Real Madrid, then Gena Korotkevich is undoubtedly the Messi of computing, scoring himself and generously supplying passes to his teammates. It is an appropriate comparison, because the boy from Gomel played a great deal of football, not only in games lessons at school. So he is a programmer, a mathematician and a player, but by no means a botanist.

CONVERSATIONS AT ITMO — BEGINNING

We met again a few days later, this time in the vestibule at ITMO. The Legendary Grand Master was wearing a light-coloured jacket with the inscription There are many ways to have fun. For Gennady programming is fun.

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In the corner of a room filled with desks we chanced upon a kind of ritual: three lads from the ITMO first team, who were to become world champions in 2017, were preparing for the event in South Dakota (USA) in a tough regime simulating competition conditions. Vladimir Smykalov, studying for a master's degree, and 4th-year students Ilya Zban and Ivan Belonogov exchanged cursory comments with Korotkevich and said hello to us, but they did not want to take their eyes off the computer even during the photograph session.

He brought the jacket back from the new Japanese AtCoder platform, to which he was invited last November. These competitions in Japan had been held previously, but the platform is now open to all-comers and Gena thought 'why not?'. It was said in a humdrum way, like: I was just passing, but go on, I think I'll play. In this first historic final the ITMO student won and received a prize of $5,000, but the money was not the most important thing, as long as it was fun.

A large photograph hangs in the vestibule: Gennady Korotkevich and Niyaz Nigmatullin with a cheque for a million or so roubles for their victory in the prestigious VK Cup. The winners were not particularly impressed by the sum, as is obvious from their faces: programming in pairs is fun.

We passed through the Computer Technology Department, the hotbed of champions. This inner sanctum is actually a suite of rooms and partitions crammed with computers and a Brownian motion of young people, one of whom was showing schoolchildren around. Others were sitting on their own or in small groups at a computer, their eyes glued to the monitor and their fingers to the keyboard, not noticing anything that was going on around them. Someone came to work and left in a hurry shortly afterwards — he obviously had other things to do. It was not immediately clear whether they were training, preparing courses or assessing the results of scientific research.

The department, to put it in newspaper speak, is a conveyor belt for training highly-qualified young programmers as part of the educational process. Its three main elements are working with promising schoolchildren, holding sessions with students on a special educational programme and taking into account graduates' individual preferences, creating the conditions for self-fulfilment. The secret of the production of personnel is actually that some of the champions and prize-winners at olympiads remain in the department after graduation, declining offers from large corporations — the creative environment and the opportunity to pursue their beloved occupation and remain in contact with friends are their priorities.

It goes without saying that ITMO does all it can to ensure that champion programmers like Korotkevich guarantee a succession of generations — so that, in the words of Professor Shalyto, they remember the sowing when they bring in the golden harvest. A wealth of opportunities, as colourful as a peacock's tail, opens up before graduates. They can study science — the department has four laboratories, including an international one, with adequate funding. Now ITMO is 56th in the Times Higher Education ratings for Computer Science, i.e. it has reached the top hundred higher education institutions ahead of time — long before 2020, as prescribed in the presidential programme 5-100. '56 is a good number — I went to High School No. 56 in Gomel', smiled Gennady.

Other options are teaching or working as a trainer, with the example of Andrey Stankevich before them. 'There are several clubs for schoolchildren. I don't run any of them, but it's great that lads from the champion teams teach in them — they can teach them a lot', says Gena.

His classmates from his student days often go into business, start their own companies or join established ones, but ideally they combine work in the department with projects on the IT market. Of course there are also those who climb the social ladder to enviable jobs outside the university, the city and even the country. For Gennady, who is on the radar of top companies, this prospect is more than real. 'I think if I had been made an offer I couldn't refuse I would already have accepted it. Obviously I am resistant', he grinned in his unruffled way. Is he not tempted by the opportunity to move to one of the world's capitals? 'I don't have a dream city where I would want to live. I like St. Petersburg and don't regret coming here.'

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Poster in the vestibule of ITMO. The victories of its student programmers at Russian and international competitions has already become part of the university's brand.

There was no way of getting this IT sphinx to talk frankly, but in the back of my mind I realized: the *tourist* had clearly explained that he was currently at a crossroads — the world is changing and so are his preferences: right now he has not committed himself to anything to the extent that he can talk about it, but he is keeping all his options open.

He spoke much more readily about his department than about himself: there are 'great teachers, but it is difficult to learn, even very difficult. Students often transfer to easier specialities. And those who don't have the time or cannot assimilate the material can catch up during the sessional exams'. Even he had to catch up: he sat the winter exams ahead of time, went home for the holidays, then sat the last exam of the session on his return. No allowances are made for champions — everyone is treated equally. After all, the essence of studying is not to just to pass or fail. It is possible to postpone a test for a valid reason (competitions, training sessions): knowledge is rated on a points system similar to that in the West, with a compulsory exam at the end of term. But most importantly, in Korotkevich's opinion, there are people in the department with experience of taking part in school and student competitions — it is just that some learn and others teach, understanding the motivation and psychology of champions. A comfortable environment is created for them: the schedule even allows for evening training sessions.

Taking a deep breath I asked him a standard question: 'What is your normal day at university like when you are not at competitions?' and got a totally evasive reply: 'My days are very different. At this stage of my life I have a fairly flexible schedule'. Surprisingly these became key words: a flexible schedule combined with inner freedom as a prerequisite for a conscious choice of career.

Left:
Bachelor and master's degree students of the Department of Computer Technology. 2017.

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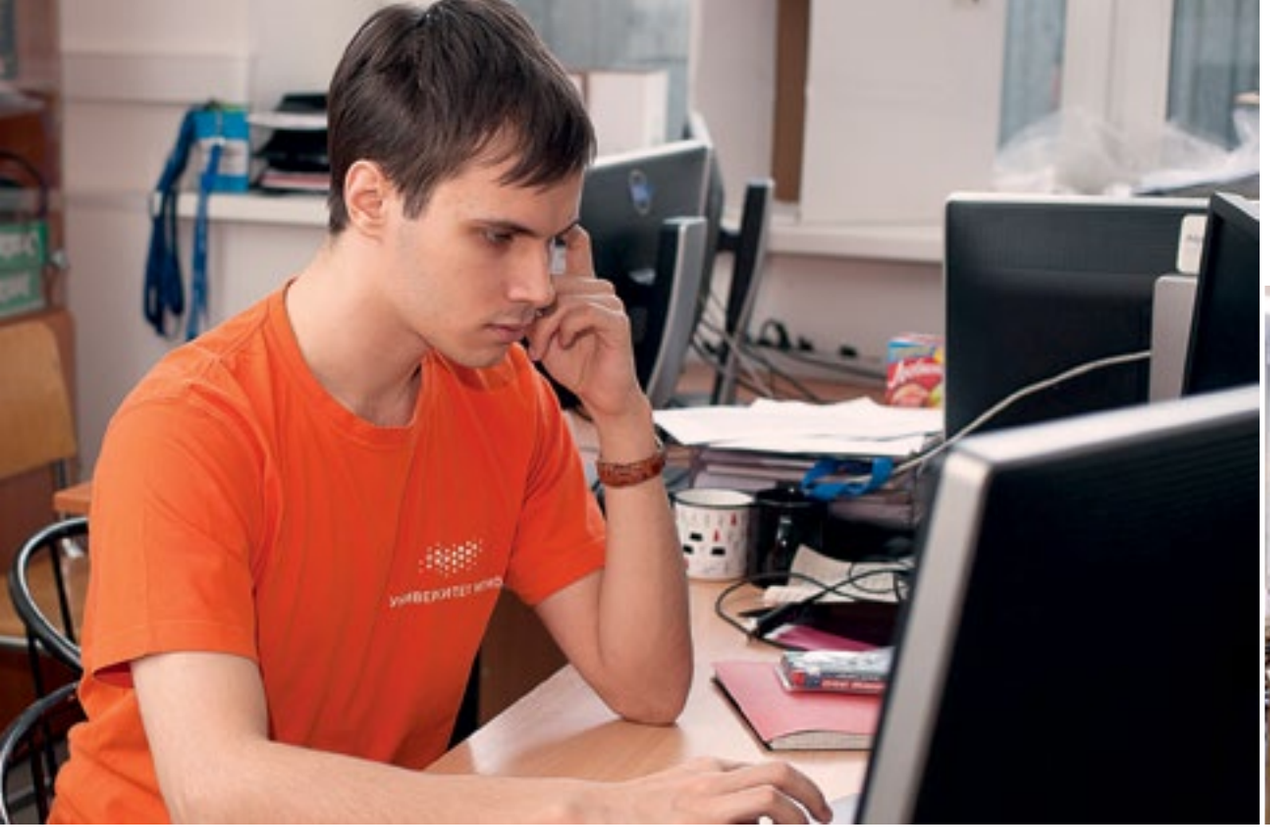

The *tourist* plans his route.

Andrey Stankevich with yet another gifted programmer.

The *tourist* is not an ideal student, as confirmed by Andrey Stankevich — not only a great trainer and organizer of olympiads, but also a lecturer in such refined disciplines as discrete mathematics, algorithms and the structure of data, functional language theory, methods of transmission and — no joke — complexity theory. He is also Gennady's supervisor in his bachelor's degree work on combinatorics, which has proved to be very interesting (how could it be otherwise?): 'The lads in the current ITMO 1st team, Ilya Zban and Ivan Belonogov, like solving the most difficult, semi-research problems which I set on my courses as facultative homework. Gena wasn't one of the particularly inquisitive ones — he had enough difficult problems to solve at olympiads, but he coped with the educational programme in full, simply because he thinks well. That is why he receives an increased grant, along with a personal one from Oleg Tinkov'.

However, these grants too are not bound by special circumstances.

CONVERSATIONS AT ITMO — CONCLUSION

When I visited the department again in autumn it was even more crowded. Vladimir Parfionov, the Dean of the Faculty, explained why: with only 120 budgetary places available they accepted 190 victors and prize-winners of school olympiads. Rector Vladimir Vasiliev, who is also Head of Department, thought it unreasonable to squander this seed material. They also took thirteen contract students who had achieved high marks in the Unified State Examinations. Another 68 Olympians were accepted in their specialization — information systems. In total there were twice as many young people than in the previous year! The Dean has mixed feelings about this new reality — half delight and half anxiety, as the lecturers' load has increased sharply: 'It's good that the lecture for the intake will be given by the cult figure of Stanok (Assistant Professor Stankevich), but who will take the practical lessons for ten groups? All these graduates of physics and maths

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Left:
'Will somebody help us or does everyone only want to take them away?' Professor Anatoly Shalyto convincing businessman Oleg Tinkov to give a personal grant to talented students at ITMO. He was convinced!

*Sometimes they return. The Dean, Vladimir Parfionov **(right)**, told me an amazing story: Niyaz Nigmatullin, a two-time world champion, decided to leave his prestigious job with a respectable company to become part of the full-time teaching staff. They told him: 'You're mad — in a year you'll lose enough money to buy a car'. 'Never mind, it's more interesting here'.*

schools listen carefully to the teacher, because sometimes they know more than he does and do not forgive any weakness. We have been rescued by our senior students, past victors and prize-winners at student olympiads who are now postgraduates — they have agreed to do some teaching. They can answer any question and there is no generation gap with the students. A cloud of young people devoted to high technologies of programming has formed around the department. We are creating the country's IT elite and that is our mission'.

As a true futurologist Parfionov went on to paint a scenario for the coming decades, when the fight for leadership in developing systems of artificial intellect (the future ruler of the world) will be waged by the elite of nations, just as it was with the atomic and hydrogen bombs. Only the USA, Russia and China meet the three basic conditions of technology superiority in this field: a large population, progressive companies who can provide attractive jobs for high-class programmers (otherwise they will go abroad) and the technologies for the formation of an elite. These countries' approach to the creation of an elite differ, however: Russia and China begin the identification, selection and training of gifted youngsters while they are still at school, whereas the Americans recruit them from all over the world when they start university or when they graduate.

In the developing computer revolution we have staked our future on the concentration of resources, including human capital. If we concentrate the flower of the nation in a few profile colleges, it will be easier and more effective for Russian IT companies to work with them. Two national research universities, the Higher School of Economics and ITMO, have detected this trend. According to Parfionov, about 60% of talented children are concentrated in them. What is more, unlike classic universities they have a noticeably greater proportion of young, professional and mobile teachers (the people in that cloud). And the HSE, needless to say, does not have such a forge of champions as ITMO.

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The concentration of world champions at ITMO is going through the roof. As two-time champion Gennady Korotkevich says, 'they are coming in herds'.

Pavel Mavrin, world champion in 2004 and now on the department's staff, wrote about this photograph on Twitter: 'The crowd of first-year students in the Department of Computer Technology 2017. At this rate they soon won't fit into the assembly hall'.

At the department schoolchildren are monitored even more closely than the students. It is a matter of demography: in each year of birth in Russia approximately 500 school-leavers (out of 1,000) are inclined towards programming, but Russian IT companies need many times more new employees than that. Where else can talented material be found than at school olympiads in information science and mathematics? Andrey Stankevich, a unique prospector for programming gold, has held dozens.

But here too Gennady is a special case. Stankevich instantly found the information in his laptop: at the All-Russian Open Schools Olympiad in 2010 the team from Gomel in Belarus which included Gena Korotkevich solved all eleven problems in 4 hours 20 minutes, whereas their counterparts from Moscow and St. Petersburg took 7 hours. Impressive? After that came the International Schools Olympiad, at which the twelve year-old won the gold medal. How could he not come to notice and, having come to noticed, be invited to ITMO?

Gena's parents are also special people. His father Vladimir, who recommended his son to choose ITMO, reasoned as a professional: it was a compact university orientated towards training in informatics and competitive programming, in particular the ACM ICPC. Large universities also offer this, but usually only as an extracurricular activity. Apart from that, if you enter a university (large or not very large) you study in your own department and in your own group. In this sense studying in a computer technology department and in a group consisting of Olympians honed to the search for new knowledge was the initial priority. Incidentally, the department's intake in that year was only 60 students... Gena certainly did not make the wrong choice: he has won a lot of tournaments, completed his master's degree and, most importantly, has found his own milieu.

He sensed he was the subject of particular attention from his first days at ITMO. This procedure is called immersing a

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school-leaver into the context of student competitions, in which everything is already on an adult level: problems of higher mathematics, theories of probability, statistics and mathematical analysis. These disciplines are not in the school curriculum, so even young champions and prize-winners at international school olympiads often lose themselves and drown in the maelstrom of student battles.

The search for a team chemistry led to the outstanding newcomer Korotkevich's inclusion in the ITMO's first team with the 2012 world champions Mikhail Kever and Niyaz Nigmatullin. Even after the first short session it was evident that nobody could introduce the first-year student to the subject better than these lads. Niyaz recalls that they trained intensively two or three times a week, shared with Gena the 'little knowledge' necessary for solving problems and occupied themselves with developing communication skills ('Team programming is unthinkable without communication', he said, quoting one of the classic exponents of the genre) and also learned from him ('He's very clever'). In this way harmony was achieved.

Gena, who was initially prepared for a lengthy period of adaptation so as not to let the team down or spoil his CV, agreed to make his debut at the ACM ICPC in his first year, and naturally did not regret it.

In forming the champion team in 2015 Stankevich and his colleagues decided on a different chemistry. They chose teammates to accompany Korotkevich as leader who had competed sufficiently among themselves and were capable of helping him in non-standard situations. At the traditional summer training session in Petrozavodsk they found the optimal combination: Artyom Vasiliev and Boris Minaev, who had already competed together successfully, winning the bronze medals at the previous World Championship. It turned out to be a good choice: Morocco, where that year's championship was held, is an exotic country — Gena

He could have repeated the words of a character in the serial 'The Meeting Place Cannot be Changed': 'Hang on. I haven't decided anything yet'.

2015 world champions Artyom Vasiliev, Boris Minaev and Gennady Korotkevich with the trophies in their university.

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The 2015 world champions were received at Smolny by Governor Georgy Poltavchenko.

did not feel well in Marrakech, but would not submit. According to the competitors and trainer, this is how it turned out. The ideal strategy for a competition marathon is not to get stuck at the start but to solve the problems in ascending degree of difficulty — for this it is preferable to sort them out immediately and solve the relatively easy ones first. The team leader dealt with the initial problems. Meanwhile, Artyom and Boris held the fort until Gena was up to speed and started to dominate as usual. As a result the ITMO team was the only one to solve all thirteen problems (eight of them by Korotkevich).

In passing, it turned out that there was no intrigue surrounding his absence from the ACM ICPC in 2014 as I had thought.

'Gena is an outstanding competitor', explained Stankevich, 'but we have many strong competitors who have been training for a long time. We gave him the chance to recharge his batteries and feel at home in the university, keeping him in reserve for the following year — with his agreement, of course. In our Olympic Training Centre every competitor, especially the top ones, has a say. Some are training with the aim of competing at the next final, others for future competitions. The success in 2015 confirmed that we made the right decision in 2014'.

The trainer explained with similar logic why Gena is so definite about the continuation of his career. We have to accept this explanation, particularly as it is shared by Korotkevich's circle of close friends. He is now close to finishing the star-studded university stage of his life and as a proud person is seeking a suitable means of self-realization. The olympiads were his Olympus and it is always hard to come down from Olympus to begin the ascent once more, even with the bonuses of medals, cups and high ratings. Any project he turns his hand to will be good and whatever occupation he may choose he will not vanish and we will certainly hear more of him. Personally I would add: the characteristic of an all-rounder is to be at home in any place — it is only necessary that it is a place that appeals to him.

Naturally he is still in the cloud, in the race or, as the saying now is, on the scene. He flew to South Dakota for the 2017 final as a member of the team of ICPC-Live, sponsor of the transmission of the World Championship on the Internet. In addition, YouTube viewers were able to see how the trio of programming monsters — Korotkevich, Pyotr Mitrichev from Moscow State University and Mikhail Tikhomirov from the Moscow Physical-Technical Institute — solved the problems the tournament competitors were set in real time and completed them quicker than the champions! For them it was just fun.

Artyom Vasiliev, who did not go to the championship, said that he kept switching between the two transmissions. He has a friendly reverence for his roommate.

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As an adviser to the World Programming Champions School which has recently been established at the ITMO (another element of a comfortable environment) Gennady met a delegation of Chinese students and gave them a lesson. When I said I had heard he had many fans in China and India, he tactfully corrected me: 'I don't know, perhaps it's because there are more people there'. And the latest news is that the champion has started holding a practical lesson in Algorithms and Structures of Data for the department's first-year students. He agreed to do this at the request of Niyaz Nigmatullin, who as a postgraduate in the department lectures to one group of the new intake in that discipline. Korotkevich took the other group and, to Niyaz's delight, has a responsible attitude to teaching the first-year students.

Of course this is no guarantee that Gennady will remain at ITMO on completion of his studies. Lidia Perovskaya, a tutor in the department whom I met after lessons, does not exclude the possibility that he might go to somewhere like Bali or Thailand and work remotely. On the other hand, why not? He is a free spirit with a flexible schedule. After finishing our conversation, Lidia glanced at her gadget: 'Several online tournaments are now in progress at the same time and Gena is probably competing in one of them'. The evening had immediately ceased to be languid.

A final brushstroke to the portrait of our hero: when Barcelona mounted their fantastic comeback against Paris Saint-Germain in the Champions League, trouncing them 6 : 1 (after losing the first leg in Paris 0 : 4), Professor texted the Leo Messi of computing: 'Barcelona won in your style. Class!' Indeed, Barça had scored three goals in the last seven minutes, including added time — reminiscent of the time allowed for solving problems at the ACM ICPC. In his texted reply Gena pedantically stressed: 'Even away from home I never lose 0 : 4 ☺'. The professor finished the correspondence: 'That means you're better than Barça'.

And so it has proved.

Have fun!

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From Why-Children to Academics

HOW THE FIRST RUSSIAN COMPETITION FOR SCIENCE THEATRES WILL BE REMEMBERED

Tatiana BELOVA. Photos: Irina Motina and Elena Ignatieva

Children today are surrounded by all kinds of clubs almost from birth, but teenagers find it difficult to decide on their future profession at the end of their schooling, when the choice is not between dancing and tennis but between physics, chemistry, biology, philology... For a school subject to become a career a child has to be nudged towards science at the proper time. This can be done by a teacher, a book or... a science theatre!

'Science for All!', the first competition for science theatres in Russia, took place in St. Petersburg in October 2017. The programme included presentations by the competitors, educational lectures, thematic exhibitions and master-classes.

The idea was supported by the St. Petersburg Committee for Culture. The competition, part of the All-Russian Science Festival, was held in three categories: a presentation of up to 45 minutes with explanations of the phenomena being demonstrated, a scientific show of up to 15 minutes and a performance in the form of a game or a dramatized production. In this way it was possible to bring together leading formats of the popularization of science for children at the meeting-point of science, art and education. The competitors also had to hold the audience with an eye-catching spectacle, involve them in the cognitive process (how is steam produced?, where does lightning come from?), leaving the children not only with vivid impressions but also a rational basis of what they had seen.

According to one member of the jury — Yulia Kupina, Deputy Director of the Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera), this type of live dramatized communication with visitors is what is lacking in children's centres of classical museums (though at the Kunstkamera ethnographic tours for pre-school children and those in the first classes at school are held in the form of a game):

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ктября 2017
УКА-ВСЕМ!"
ль-КОНКУРС НАУЧНЫХ ТЕАТРОВ


ДНК
ДРЕВНЯЯ
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Alyona Sergienko and Stas Burykin from the Why-Children Academy in Chelyabinsk acted as professors to show children a series of magical transformations of chemical substances so cleverly and dynamically that there was an endless stream of children wishing to take part in the show. The highly-experienced manager of the theatre Elena Tkachenko (a qualified teacher, economist and executive) described how the project had begun about ten years ago in a chain of shops selling educational games and how three years later they had added dramatized scenes from scientific life. This is typical: the shops could no longer compete with the large trading chains, but the science mini-theatre is alive and thriving. Elena explained this quite logically: children like it and it is becoming fashionable to be clever — it will stand them in good stead for the future!

Right:
The jury was also fascinated.

'Today's children have to be enticed into science! You can't just cram them with information. For children to begin to read and learn adults must learn how to act and be interesting themselves. After all, science is competing with show business, which has highly-paid set designers and progressive directors'.

Another jury member — Alexey Zavarzin, Deputy Director of the *Talent and Success* foundation (*Sirius* Educational Centre), also highly appreciated the opportunity to select the best scientific-educational experiments, shows and programmes which could become part of general education.

How do science theatres originate? For example, *ElectroSHOCK!* in St. Petersburg was started by two Anastasias — Maximova and Tilina. Both are actresses: Maximova is a graduate of the Irkutsk Theatrical School and Tilina of the School of Russian Drama in St. Petersburg. Maximova always got a solid three out of five in physics at school, while Tilina, in her own words, got an undeserved four. But Anastasia Maximova's husband is an engineer-physicist, which helps not only in raising the level of knowledge but also in the making of original props for performances.

Friends suggested the idea of holding events for children, but being simply entertainers seemed boring. Popularizing science was another thing entirely. In fact, it is a pity, as Tilina said, that for many kids Tesla is the name of a cartoon hamster. In their 40-minute performance the duo demonstrate the wonders of static electricity: how the hair literally stands on end. But that is just the first burst of interest in physics and its laws — the so-called WOW effect! It has to be followed by prolonged activity — joining a club at school or a Youth Centre for Creative Activities. If kids are not given this opportunity, 'the effect is thrown to the winds'.

The festival identified another problem. Professionals with a profound knowledge of their subject are often unable to speak about it in an entertaining way. Actors can do this much better, but they lack the basic knowledge. It is time to throw down a challenge: where are you, popularizers of science? One of them — Sergey Stafeev, Professor at the ITMO University and founder of the Museum of Optics — was another member of the jury. He insistently invited the festival's participants to visit his museum in Birzhevaya Line — for discoveries, impressions and methodological developments.

Along with dramatized shows the festival also featured museum and educational projects in St. Petersburg. It turned out that half of those involved in these projects are bringing to fruition the

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ideas of major companies, which are gradually forming their future personnel. The other half are simply teams of enthusiasts sponsored by municipal authorities or private investors.

For instance, an archaeology club in the Krasnoye Selo District demonstrated the life of St. Petersburg citizens in the 19th century by means of its finds. In the play area of the information centre on atomic energy a virtual tour of a nuclear power station was conducted. The creators of the *Petrovsky Basin* museum model showed how to tie naval knots and forecast the weather. Visitors to fab labs learned how a thereminvox works, drew with 3D pens and controlled electricity. Violins printed on a 3D printer were a wonder of technology, musical art and design. The Russian School of Pharmacists organized the preliminary selection of senior pupils for entry to the St. Petersburg Chemical-Pharmaceutical Academy.

The final note of the festival was the announcement of the results of the competition. The winners included the aforementioned *ElectroSHOCK!*, the team from the *Laboratorium* Interactive Science Museum in Rostov-on-Don, the *Why-Children Academy* from Chelyabinsk and the *Quantum* Museum of Entertaining Sciences from Minsk. However, as the competition's co-organizer Tatiana Cherneyko pointed out, all the competitors deserve praise for their self-sacrifice and devotion to science theatre, which they often have to combine with study, work and family obligations. Science theatres must also not forget economics in order to survive: from a commercial point of view it is the same sort of business project as a kebab kiosk. Another similarity, perhaps, is that a tasty dish is easier to sell.

Since the festival was, by common consent, a success, the organizers' next task is to make it an annual event with the support of the city authorities and the scientific-educational cluster. And also to include it in the programme of the next St. Petersburg International Cultural Forum.

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So many children wanted to let the gin out of the retort, touch the lightning, see the fluorescence of plasma with their own eyes, brandish an electric sword like a knight...

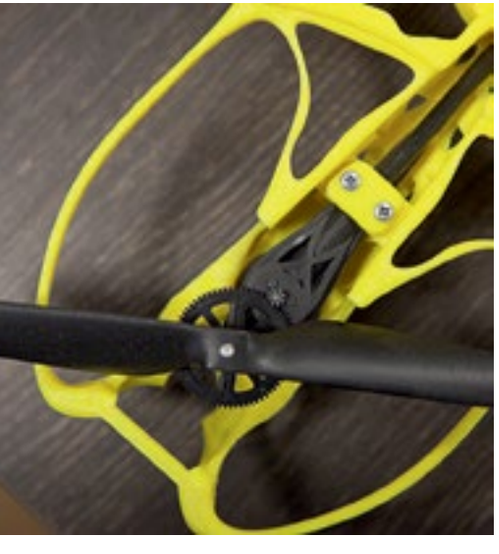
The audience was delighted with the Sozvezdiye (Constellation) team of teenagers from St. Petersburg. The schoolchildren staged a lively and jolly production based on the diaries of Alexander Pushkin and his contemporaries. Now the amateur actors, their relatives, friends and classmates are starting to read Pushkin. They are not cramming literature and history but discovering for themselves the world of that time in an interesting way. The members of the jury watched the production and resorted to their gadgets to verify the quotes from Delvig and Baratynsky — there you have the magical power of art...

It turned out that many people were looking forward to the festival of science theatres: the State Hermitage and universities, participants from Russia, Belarus and Estonia (for them the competition was a unique way of meeting one another and exchanging professional experience) and the public, both young and old. It is evident that the edutainment format — at the meeting-point between science, education and art — will complement and enrich the work of museums and generate new subjects for secondary and high schools.

Beyond Intuition

PROFESSOR ALEXEY BOROVKOV OF THE PETER THE GREAT POLYTECHNIC UNIVERSITY IN ST. PETERSBURG DESCRIBES HOW *FACTORIES OF THE FUTURE* ARE NOW BEING SHAPED.

Arkady SOSNOV. Photos: Timur Turgunov, the Archive of the CompMechLab® Engineering Centre at St. Petersburg Polytechnic University, the Press Centre of the *Young Professionals* Agency of Strategic Initiatives



Alexey Ivanovich Borovkov has a plethora of appointments, each of which would suffice as a full-time occupation: Pro-Rector for Long-Term Projects at St. Petersburg Polytechnic University, Senior Adviser to the Institute of Advanced Production Technologies, Manager of the *5-100* University Programme, Professor in the Mechanics and Control Processes Department, Leader and Co-Director of the *Technet* Working Group (a cross-branch project of the National Technological Initiative — NTI), Member of a Working Group of the Russian President's Economic Council on the Digital Economy, Head of the *Factories of the Future* Design Office in St. Petersburg, and finally Director of the CompMechLab® Engineering Centre at St. Petersburg Polytechnic University, which provides services to companies in various branches of industry — the motor industry, aviation, shipbuilding, oil production... This versatility is down to the fact that this is the only *computer* engineering centre in the country using full-scale digital models with a high degree of relevance to actual objects and processes (*smart models*).

Professor Borovkov has been informally described as a specialist in solving insoluble problems. Who is involved in the production of cars with unique characteristics for the President of Russia? Borovkov's team. Who was able to ensure the efficiency of the main circulation pumps' operating wheels at the Tianwan Nuclear Power Station in China for the next forty years? Once again, the engineers in Borovkov's team. The list goes on...

The CompMechLab® has proved its international competitiveness by working with leading international corporations — not just on individual projects but on a regular basis, tuning into their technological circuits. Just as importantly, the Engineering Centre is involved in the transfer of technologies at the same level, taking

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world trends into account, carrying out Scientific Research and Experimental Design for leading Russian companies, including in the energy, shipbuilding and aviation industries.

As long ago as 1987 Alexey Borovkov founded Russia's first computer engineering laboratory — ten years earlier than a similar structure appeared in Moscow University. It was that laboratory that became the conceptual, creative and personnel base of the Computer Engineering Centre at St. Petersburg Polytechnic University. Looking back a few more years, he graduated from what was probably the most progressive faculty in the university — the Physics-Mechanics Faculty, founded by the legendary Abram Ioffe and Stepan Timoshenko (who subsequently made Stanford University in the USA famous), where the Deputy Dean was Pyotr Kapitsa, who went on to found the Physical-Technical Institute in Moscow. It is symbolic: today Borovkov, an alumnus of the Soviet scientific-technical school, has become a visionary extending the horizons of the new digital economy.

— Alexey Ivanovich, you are one of those people who not only look to the future of our economy but are bringing that future closer. In these uncertain times for the economy how realistic is it to be planning factories for 2035?

— The first thing I would say is that the National Technological Initiative was launched by the President of Russia in December 2014 and is now one of the priorities of government policy. It is a long-term all-embracing programme to guarantee the global competitiveness of our economy until 2035. How can it be guaranteed? Besides the gradual development of enterprises and companies, we have to direct our energies towards future markets — mainly the so-called *nets* (network-based markets): *Aeronet*, for example — distributors for pilotless aircraft, *Avtonet* — the driverless car market, *Marinet* — the market for marine intellectual systems on and under the water.

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A conversation to the point. Academician of the Russian Academy of Sciences Andrey Rudskoy, Rector of the Peter the Great Polytechnic University in St. Petersburg, Professor Alexey Borovkov and Nikolay Tsukanov, Plenipotentiary Representative of the President of the Russian Federation in the Northwest Federal District, in the Polytechnic University's Engineering Centre. At the computer — Leading Engineer Ivan Stebenev.

The most extensive of them is *Technet*, aimed at the development and use of advanced production technologies. This is, above all, digital planning and design, the creation and use of new materials (I would particularly mention metamaterials and composition materials), additive technologies (that market is growing at approximately 30% per year, at a time when the standard market is growing by only 5–7%), total automation and robotization of manufacturing.

Then, of course, there are *Big Data*: industrial robots will report on themselves and interact with one another. There is now an *Internet of Things*, or an industrial Internet — streams of data which have to be collated, structured, analyzed and used, i.e. controlled. For example, a supermodern gas turbine generates 500 terabytes of informative data every twenty-four hours and that information has to be used both for controlling the operation of the turbine and for making new generations of turbines. The *Internet of Things* is developing in almost everything around us, in all the gadgets we use. Smart homes and smart cities will come whether we want them or not.

The necessity of *Big Data* analysis is to stimulate the development of predictive analysis and digital design, and for that high-performance capacities are needed. The Polytechnic University has one of the most powerful supercomputers in the country, aimed specifically at use in industry.

Factories of the Future are bringing together everything I have mentioned and generating new-generation specialists with the necessary competences. In *Factories of the Future* it will all come as a package: planning, design, analysis and distribution in a digital format. Digital transformation is no longer a fashionable trend but an urgent necessity and the current reality of modern hi-tech production.

Some people think *Factories of the Future* is an attractive image, a meme, but in actual fact they are an integral element of the 4th Industrial Revolution that is now happening — a structural link and, I would say, the quintessence of the digital transformation of the economy.

— A key project of the Polytechnic University and its Engineering Centre is *Cortege* — the development of a range of presidential-class cars. To what extent have you used digital technologies in this project?

— This project has actually served as an example of the 'solution of insoluble problems' on the basis of digital technologies, not only in the motor industry. In 2014 the task of making four

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cars on a single modular platform was announced: the Russian motor industry replied that it was impossible to make them within the allotted time. We, in conjunction with the Central Scientific Research Automobile and Automotive Engine Institute, managed to do it and the result was confirmed in June 2016 on an independent testing area in Berlin: at the very first attempt the sedan was given the highest mark in passive safety. What led to this success? A unique ecosystem of technologies, a digital platform and a team of engineers with world-class competences who are ready to use them at any moment, to work with any company interested in change.

The question arose as to whether this approach could be extended to other branches of industry. And shortly afterwards, at the Forum for Strategic Initiatives attended by the President of Russia, we were offered the megaproject *Factories of the Future*. It was confirmed and is undoubtedly serving as a spur to the development of all sectors of the economy. In the motor industry, for instance, in about two years' time we will be close to the creation of open digital platforms providing new opportunities for small and medium businesses, including in the regions, to become part of the process of producing their own cars.

Professor Alexey Borovkov presents the *Factories of the Future* project to President Putin at the Forum of Strategic Initiatives. Moscow, 21 July 2016.

— Is it possible to speak of a particular road for the Russian economy? How tempting it would be to avoid all the ruts and potholes at the side of the road and set off down the wide highway of scientific-technical progress...

— We do not have the right to isolate ourselves from the dynamic processes of world development. With such an approach the country would inevitably start to grow weaker, and then we would not be able to speak about any defence capability nor about the greatness of Russia.

There is an expression which German Gref brought back from Silicon Valley: when we are just preparing to discuss something over lunch, the Chinese have already been doing it since morning. However, it should be taken into account that Russia is extremely creative. Russia is one great design bureau: we know how to design, but we do not know how to be really competitive in mass production. The Fourth Industrial Revolution will enable us to add value in areas where we are strong and offset our weaknesses: by using advanced production technologies and the business model of *Factories of the Future* we will be able partly to exclude the human factor in production, draw up distribution networks of certified suppliers, reserving the right to expertise in digital planning and design, i.e. key competencies. It will be a fundamentally different economy.

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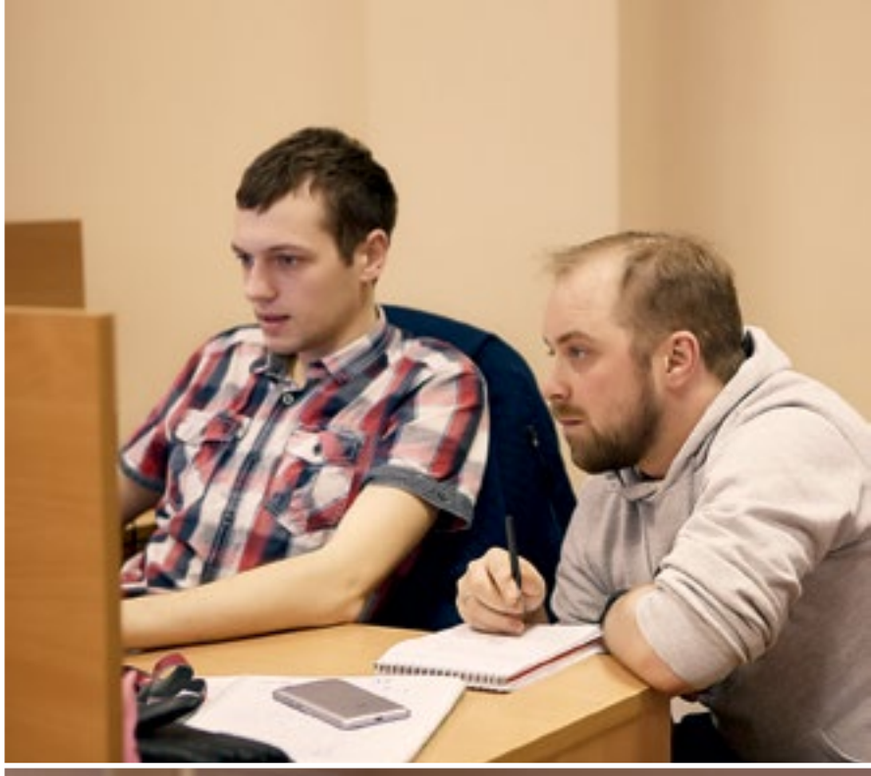

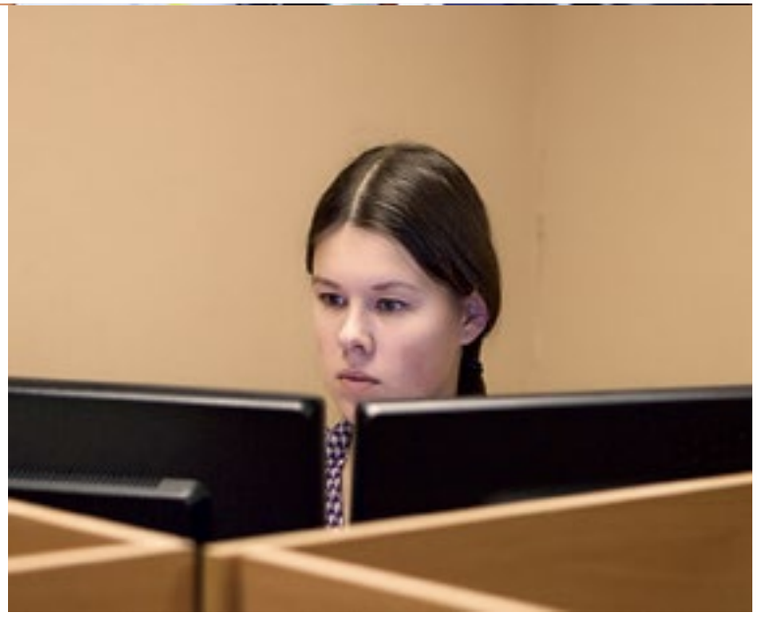

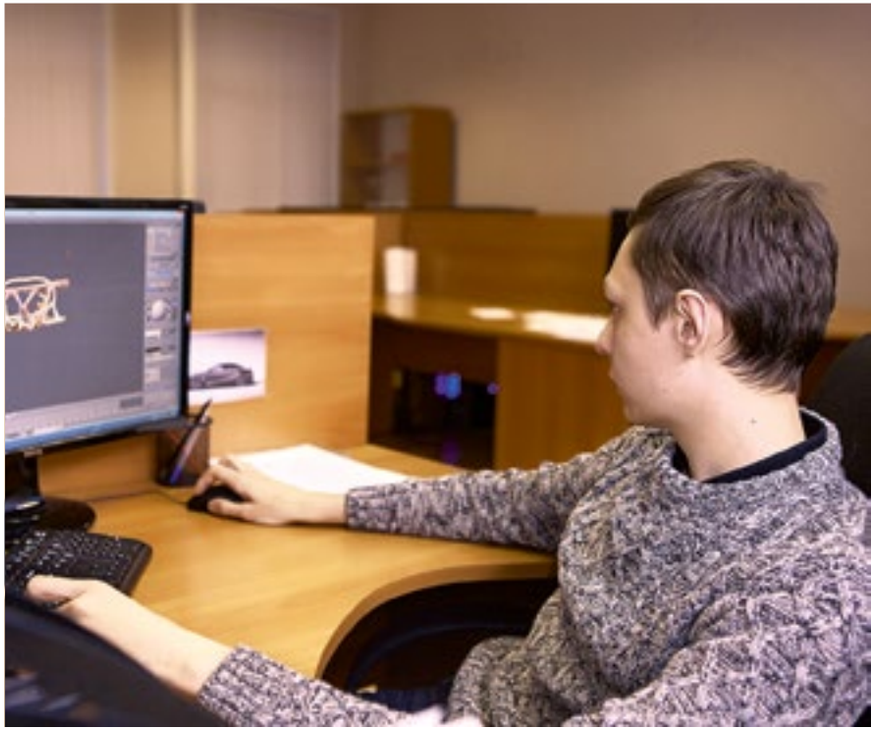

The principle of educating students in the Institute of Advanced Production Technologies is gradual immersion in real projects. In other words, studying by means of actual Scientific Research and Experimental Design projects.

— What is the role of universities in building the economy of the future?

— Going over to a digital economy will require a different class of specialists — that is a challenge for universities, as the traditional cycle for the training of specialists is 5 or 6 years. It is obviously necessary to solve a whole range of problems in education, research and development: to set up applied graduate studies by carrying out actual Scientific Research and Experimental Design projects, to run topical problem-orientated projects, to develop key competencies in universities' engineering centres, centres of competency and engineering companies. It is important to set up a digital ecosystem as an infrastructure — to create virtual experimental testing-grounds as centres for the assembly, testing and efficient use of advanced multidisciplinary and cross-branch computer technologies. And, of course, the main task is the formation of world-class competencies. The slogan 'Competent personnel decide everything' has never been as relevant as it is now.

At the Polytechnic University we are already running a training programme for new-generation specialists via the Institute of Advanced Production Technologies. These *engineering special forces*, as our Rector Andrey Rudskoy calls them, will create knowledge-intensive products adapted as closely as possible to the demands of the market and specific consumers. A university-type experimental testing-ground is being created on the basis of the Polytechnic University's Institute of Advanced Production Technologies — as a prototype and generator of digital factories for various branches of the hi-tech industry.

Our *5-100* programme is aimed at the integration of Russian higher education establishments into the international educational arena and guaranteeing their competitiveness. In autumn 2016 the priority project *The Contemporary Digital Education Environment in the Russian Federation* was approved with the aim of creating the infrastructure, standards and legislative basis for high-quality and accessible online education. The colleges and universities in this project integrate into the international scientific education arena, act as centres of innovation and should operate in close contact with business in the concept of continuous education.

Oleg Bocharov, Deputy Minister of Trade and Industry, holding a bracket for the aerospace industry, optimized in accordance with the principles of bionic design.

— And is the Fab Lab also part of the economy of the future?

— The Fab Lab is another story, aimed at the development of creativity. Unfortunately it is outside the ambit of what is required by the hi-tech industry. It is all very well and interesting, but the solutions they come up with cannot, as a rule, be applied. It is a sort of island of enthusiasts who want to create and communicate with one another, which is great, generally speaking.

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The customized electric CML-CAR, being developed in the Engineering Centre.

— It is now 2017, but when the Internet markets take over the world economy, which is what the National Technological Initiative is aimed at, it will be 2035. So the people who will be at the most mature age then are now 18–20, but you have to make the choice here and now. How do you pick out the creators of the digital economy before sending them to the frontier of technology?

— It is a long and painstaking process. We do not strive for mass inclusion but for the minimization of random choice — the search for motivated students who realize that learning will not be easy. As before we start the process almost while they are still at school, but in earnest when they are in the third year at university. The technologies of the world's leading companies become more knowledge-intensive and multidisciplinary year by year, and the specialist of the future will need engineering, aerodynamics, heat and mass transfer, materials science and electromagnetism, all underpinned by maths and physics. Of course many of them want to design the best cars in the world, but experience has shown that only one in ten is suitable, and only one in twenty has the necessary knowledge, mentality, competences and the ability to work without mistakes. Incidentally, thanks to the Unified National Exam youngsters from all regions of Russia now have the chance to join the new economy — over 60% of our students are from other cities.

So, from the third year onwards we select the best, follow their progress and appoint them a tutor (a qualified working engineer, not a professor) to whom they can apply at virtually any time. This very quickly helps to remove barriers of misunderstanding and save unnecessary stress, and the young person gradually becomes involved in real projects and finds a job. The structure of education is changing fundamentally. It is now 50% formalized knowledge (lectures and seminars) and 50% informal knowledge obtained in the course of a real project working alongside experts.

The main stimulus for the development of *engineering special forces* is interesting tasks — very interesting ones. Sometimes, even when he joins a global oil and gas company, a specialist after a while begins to realize that he has reached the limit of his development and will not develop further in the next 15–20 years. And so he comes back to us — for a salary comparable with the international level for employees, but also for the most interesting tasks and various Scientific Research and Experimental Design projects.

The articles are supported by a St. Petersburg grant

— And are there plenty of tasks? After all, we are not all living in 2035 as you are...

— There certainly are: the number of complex tasks is increasing, as is the queue of customers — not only Russian customers, but Russia too is expanding with the NTI and the *Factories of the Future*. Industry is manufacturing new products and cannot do without advanced technologies as it is faced with complex problems that are already beyond the bounds of intuition. A developer does not understand how to take into account the mutual influence of different components in the operating process. Previously expensive field studies came to the rescue. Today there is not the finance or infrastructure for such experiments, but any design can now be calculated to a high degree of accuracy and tested virtually.

— Calculated beyond the bounds of intuition?

— We obtain solutions that cannot be generated by intuition. In one of my lectures there is an illustration of this boundary: there is a solution within the limits of a head designer's intuition and there is a solution obtained by us beyond the bounds of intuition — essentially the digital twin of an actual object. Moreover, the world will learn of this solution within one, two or three years. The world's leading companies do not release such solutions on to the market immediately, since they are leaders even without them. These solutions will be released whenever there is a threat to their leadership. This is a different business model characteristic of the new digital economy. That is why it was stated at the World Economic Forum in Davos at the beginning of 2016 that only 20% of companies will survive in the new economy. And it really will be possible to join the new economy only with advanced technology, not with a slide rule.

— The search for leaders of the NTI has to encompass the whole country, and obviously primarily in universities. How is it being organized?

— The intensive financial support of leading Russian universities began in 2007. It is now 2017, and the NTI is aimed at making us the leaders in the field by 2035. There is a term *growth point*. It is deplorable if these points remain points from year to year, from programme to programme. It is my profound conviction that after ten years of substantial support of leading universities these points ought to have grown and become expanses of growth. In some areas this has happened: science and science education centres of international standard have been established

The Polytechnic University and the Engineering Centre signed a collaboration agreement with the group of companies for the creation of a *Factory of the Future* for space technology. The university's engineers have been involved in rocket and aircraft building for quite a long time. Under the *Factories of the Future* megaproject, in conjunction with leading specialists from this industry, they have succeeded in selecting urgent industrial and corporate problems-challenges which can be solved with the aid of digital twins.

The articles are supported by a St. Petersburg grant

Maxim MEIKSIN, Chairman of the St. Petersburg Committee on Industrial Policy and Innovations:

— We want to see a St. Petersburg that is not only beautiful and cultural but also a hi-tech city. As soon as the NTI was introduced Governor Georgy Poltavchenko supported the initiative and we approved a programme under which we will be opening a new engineering centre of a specific type every year as accelerators of industrial development. We have already opened a centre for the synthesis of active pharmaceutical substances and an engineering centre for cyber-security for the IT industry is about to open. Our plans for the next two years are engineering centres for radio-electronics in 2018 and for photonics in 2019.

Education is the second important segment. NTI Olympiads have started to be held in schools and the teenage generation are more and more actively embracing the logic of the digital economy. Interesting trends are appearing in St. Petersburg more strikingly than anywhere else. In recent years we have observed an active demand for engineering specialities in the hi-tech industry and increased competition in chemistry and biology. The Kirov Plant has a tradition of taking on youngsters entering a profile college as employees and this year there are nine of them competing for each job.

and forty engineering centres have been created by the collaboration between the Ministry of Education and Science and the Ministry of Trade and Industry. The purpose was to create no more than one such centre in each higher education establishment, but with installations targeting leadership in that particular area in the country and in the world. Creative spaces are springing up around them, teams of innovators are being formed and the NTI is aimed at the selection of these teams. It could be a small or medium business, or allotted hi-tech subdivisions in companies (*Greenfields*) which demonstrate the highest productivity and economic efficiency against the general background. They grow more quickly than the others, which is evident from the results of the *Business Gazelles* competition held in St. Petersburg.

There are other Russia-wide projects aimed at the search for leaders and their targeted support. The Innovation Assistance Foundation (Bortnik Foundation), a Russian venture company, is already holding competitions under the NTI. So the average approach to *sowing*, where finance is shared equally among everyone, is already a thing of the past — everyone may grow, but the majority will not withstand the competition. In fact the federal authorities are focusing attention on the leading teams on various levels, in both companies and universities. In this situation it is important that we remain at the forefront of technology, increase the export of hi-tech services and continue to work with world leaders.

— Is it with this in mind that the Polytechnic University has opened a branch in Shanghai?

— Yes, since last spring we have actively begun to establish contacts with Chinese hi-tech industries and, owing to the range of competencies of the Polytechnic University and its Engineering Centre, we have been able to form a pool of sixty companies which are prepared to work with us. We have simplified as far as possible the chain of communication with customers (bypassing Chinese universities, science parks, etc.). China is developing at such a rate that we always have to be a few steps ahead in order to maintain a balance of interests. We have opened a Higher School of Technological Entrepreneurship at the Polytechnic University with the accent on hi-tech. It will help to set up new businesses on a global scale and, in particular, to establish stable business with China, the leading world economy, so we at the Polytechnic University and the companies connected with us are interested in it in the long term. For this it is necessary to 'run forward faster than you are driven, scattering fields of intellectual know-how behind you'.

— The 20.35. The *National Technological Revolution* conference held in November in St. Petersburg summed up the year's results in the National Technological Initiative. What sort of year has it been for *Technet*?

— The first and most important event for *Technet* was the approval in February of a road map for it. Our working group has been very active: it has considered more than ten projects, mostly those of *national champions* (to use the Ministry of Economic Development's terminology) and hi-tech *business gazelles*. It is gratifying that the sparring partnership between *Technet* and *Factories of the Future* is gathering speed.

The point is that those participating in the *Factories of the Future* megaproject (and that is already around thirty substantial businesses of various types) are filling a gap that exists in the NTI — major businesses. Currently the NTI serves as a support for small and medium businesses, but we recently supported a project to create a *smart factory* based on a leading engine-building company (the cost is seven billion roubles of state and private finance).

The articles are supported by a St. Petersburg grant

At the *20.35. The National Technological Revolution* Conference. St. Petersburg, November 2017.

Photo on page 31:
The award of diplomas to master's degree students of the Insitute of Advanced Production Technologies.

Design consortia are being set up as part of the partnership between *Technet* and the *Factories of the Future* project. This trend has been noted in car production, aircraft building, helicopter building, engine building, shipbuilding and so on. An innovative ecosystem of small businesses in receipt of support from the Bortnik Foundation is beginning to form around major companies. It should be noted that *Technet* has one of the leading coefficients of the efficient use of company funds: 80% of them go towards achieving the targets specified in the road map. The innovations that are being created immediately become part of the concept of virtual factories, i.e. some of the hi-tech services, competencies and equipment can be replicated and upscaled.

— We are cutting corners, in the words of one of the speakers at the conference, in striving towards 2035, but foreign corporations are also not marking time. How can we avoid being left standing by their leap forward?

— I noticed that just this August the key term the Fourth Industrial Revolution — a digital twin — appeared on the curve of advanced technologies drawn by the Gartner analytic company. There is a sense that in the last ten years the world's leading companies have been employing diversionary tactics: they have launched fashionable trends like the industrial Internet, robotics, cyber-physical systems (all these are useful but auxiliary initiatives) and have 'forgotten' to say that for ten years they have been intensifying the creation of digital twins — both of actual objects and of actual production. Imagine a field of competition in which half the business of one of the players is 'concealed' in digital twins, which 'lie in ambush' and can 'spring out' into actual production at any moment. An invisible fundamental change is taking place in industry. Whoever generates digital twins that are relevant to real objects in the whole life cycle will dominate in tomorrow's world.

— And are there digital twins in the Polytechnic University's Engineering Centre?

— We are creating them in conjunction with companies — the world leaders in recent years. They are actually *21st century superweapons* which have to be used sensibly. A twin can be complete, i.e. almost fully adequate for an actual object and/or actual production, and then it can travel along the life cycle at the leader's pace.

The articles are supported by a St. Petersburg grant

Alexey Borovkov. Thinking Aloud

One of the problems of engineering education is that lecturers in senior courses at higher educational establishments have not worked in industry in the last 10–20 years or have never worked in industry.

According to European statistics only six per cent of the innovations proposed by technological entrepreneurs actually reach industry. It is more logical to take specific tasks-challenges from the hi-tech market and resolve them as our engineering centre does. That is the only way of compensating for the gap between the complexity of the task and the level of competences of the companies' personnel. And for us it is important that these tasks develop us and enable us to move forward, capitalizing on the experience.

I remember when we began our collaboration with a well-known American corporation: we worked on the task for four months, they then took three months to accept it and only after that were we paid. That was in 2000 — very strict conditions with daily monitoring and weekly reports. At that time we were already thinking in the Soviet way: if we can't finish it in time, we'll just extend the deadline for a day or two. We had to be re-educated.

As early as 2004 the U.S. Competitiveness Council launched a national programme for the manufacture of supercomputers and proclaimed that the winner in the competitive struggle would be the one who came out on top in calculations. And today the slides in presentations by world leaders feature endless, abundant calculations which guarantee the exponential growth of the economy. And what we are promised by artificial intellect is linked to the endlessly growing potential of calculations.

Global trends develop regardless of our wishes and readiness for change. There is only one criterion for evaluating a result: the competitiveness of the product on the world market.

If we do not promptly digitize the results of the on-site experiments which were conducted in the USSR for huge sums for finishing products and items and do not master virtual trials, it will be difficult to achieve great progress in, for instance, the aerospace industry. To paraphrase Newton's dictum: the achievements of our engineers are due to the fact that we are standing on the shoulders of giants.

Man has to get wiser more quickly than intellectual technical systems — that is one of the main challenges of the 21st century.

The CompMechLab® Engineering Centre at St. Petersburg Polytechnic University receives around 250 delegations a year. Some come for familiarization, some to discuss ways of collaboration, others to sign contracts.

The articles are supported by a St. Petersburg grant

Transmitting Health

SCIENTISTS AT THE PETER THE GREAT POLYTECHNIC UNIVERSITY ARE CREATING THE FUTURE OF BIOMEDICINE

Natalya MAKHOVA. Photos: the Polytechnic University Press Office, site scardio.ru

A handmade hi-tech bio-prosthesis.

'Into whatsoever houses I enter, I will enter to help the sick.' That line from the Hippocratic Oath is becoming exceptionally relevant today with the proliferation of translational medicine and the diminishing distance between promising developments and their practical use. This is largely on account of a new paradigm in medical science and innovative technologies which give researchers the possibility of looking into the hidden depths of the human organism. The characteristics of biomedicine are the interpenetration of life sciences (biomechanics, biophysics, biochemistry, bioinformatics, neurobiology, psychophysiology, genetics...), the modelling of pathologies in laboratory conditions with the aim of identifying the mechanisms of diseases and the search for new treatments for those diseases. Only universities can provide this interdisciplinary approach.

A graphic example of this — the Peter the Great Polytechnic University in St. Petersburg — is one of the leaders in this field in Russia, striving to develop according to Model 4.0, where a combination of material resources, competences and high technologies makes it possible not only to solve problems that are not within the compass of separate branches of industry but also to make an invaluable contribution in the public health domain. An innovative ecosystem is forming around the university, generating hi-tech biomedical designs.

In 2015, in conjunction with the Almazov National Medical Research Centre and several other educational institutions in St. Petersburg, the Polytechnic University set up the Translational Medicine science-education cluster. One of the cluster's main purposes is to carry out a full cycle of scientific research and experimental design work, including making preparations and industrial prototypes of appliances which can actually be used in doctors' daily practice. In 2016 the Polytechnic University and

the Shanghai Biotechnology Corporation signed a collaboration agreement and in October 2017, following a decision by the university's Academic Council, a new structural subdivision was founded — the Institute of Biomedical Systems and Technologies. This is by no means a spontaneous step or a nod to fashion — the Institute's programmes have already been running for two years as part of the 5–100 project. It will train specialists capable of meeting the most difficult challenges that face medicine and threaten public health in conditions of heightened stress, technogenic dangers, mutations of viruses and the deteriorating ecological situation on the planet. This important scientific-educational project is being implemented in conjunction with the Almazov Centre.

The modern world is rapidly changing perceptions of professions, making urgent demands of them. Doctors in the 21st century not only have to be up to date with advanced methods of diagnosis and treatment but also to actively introduce them into clinical practice and approach each patient individually, relying on the data of molecular-genetic and epigenetic examinations. This has prompted the Polytechnic University to solve a number of important problems at once in the field of hi-tech biomedicine. The university is contributing to the formation of multidisciplinary teams in which specialists in biomedicine and mathematics, mechanical engineers, chemists and even economists will work on an equal footing with clinicians. These specialists are also being trained at the university. Students of the Institute of Biomedical Systems and Technologies will learn truly innovative specialities: molecular design and bioinformatics, biomedical machinery and materials, nuclear and quantum medicine, cellular and regeneration medicine, neurobionics and medical robotics. Training of new-formation medical personnel on a master's programme will begin as early as autumn 2018. It is planned to take 10–15 students with basic medical education who will receive superscientific hi-tech education at the Polytechnic University and its partner institutions.

The Polytechnic University is also training medical specialists in its foundation department, which works effectively with the Russian Ministry of Health's Influenza Research Institute. The Institute's staff gives the students courses and hold laboratory sessions which facilitate their immersion in the profession.

Scientists at the Polytechnic University have already created several original medicinal preparations and technologies and have passed them on to medical institutions. For example, the staff of the Medical Ultrasound Apparatus laboratory under Alexander Berkovich have developed Russia's first diagnostic scanner for the identification and ultrasound treatment of cancerous tumours at an early stage without surgery. The scanner is in demand when tumours appear in the mammary and thyroid glands, the kidneys, liver and other organs. And ultrasound can be used simultaneously for diagnostic, therapeutic and thermometric purposes. The non-invasive treatment avoids surgical scars and post-operative complications. The university, in conjunction with the Novosibirsk

'With the help of our colleagues at the Polytechnic University we wish to introduce all the latest and best there is in science today into the doctor's surgery. I hope this lofty ideal — and we are looking beyond the horizon — will enable us to implement a pilot project for the training of specialists on the basis of new biomedical research'.

Evgeny SHLYAKHTO,
Academician of the Russian Academy of Sciences, Honoured Scientist of the Russian Federation, General Director of the Almazov Centre, President of the Russian Cardiology Society, Head Cardiologist of St. Petersburg and the Northwest Federal District

Left:
The Peter the Great Polytechnic University is working on the creation of new medicinal preparations and technologies.

At a session of the presidium of the Presidential Council on the Modernization of the Economy and Innovative Development of Russia held at St. Petersburg Polytechnic University Prime Minister Dmitry Medvedev was shown a bionic prosthetic arm made by students at the university in conjunction with specialists from the Turner Children's Orthopaedic Research Institute. Right — Rector of the Peter the Great Polytechnic University Academician Andrey Rudskoy. June 2016.

An apparatus for the removal of cancerous tumours with the aid of ultrasound has been developed at St. Petersburg Polytechnic University.

Instrument-Making Plant, is planning to start production of the scanner and put it on the market as early as 2019.

Ultrasound has also proved to be an effective treatment for varicose veins. The technology developed by St. Petersburg Polytechnic University has no analogues in the world. According to World Health Organization statistics, tens of millions of people currently suffer from varicose veins. The disease attacks the veins of the lower limbs and the venous valves which help the circulation of blood from the legs to the heart. The essence of the new method, which requires no great financial expenditure or major surgery, is that the ultrasound seeks the affected part of the blood circulation system. Depending on its depth in the patient's body a computer program selects the course of action and focuses a 10kW/cm^2 ray on the area to be treated, heating it to a temperature of 70–90 degrees Celsius. The procedure takes just a few minutes.

Another breakthrough in biomedicine achieved by the Polytechnic University's Nanobiotechnology Research Complex is the creation of a harmless peptide which prevents the adaptation of bacteria to antibiotics. This was a joint project with specialists from the St. Petersburg Nuclear Physics Institute (the National Research Center 'Kurchatov Institute'). It is known that bacteria constantly mutate and acquire the ability to nullify the effect of antibiotics. On a genetic level the peptide created by the scientists shuts down the systems of the accelerated evolution of bacteria. The method's effectiveness has already been proved and it has obtained a patent entitled Family of Peptides — Inhibitors of the Activity of RecA Protein Blocking Bacteria's SOS Response. This discovery should raise to a new level the effectiveness of preventive measures and the treatment of infectious and parasitic diseases, reducing their duration.

The Polytechnic University is also involved in the search for HIV vaccines and bio-agents for the treatment of Alzheimer's

disease. The fight with this global disease, which is becoming more widespread with the aging of the world's population, has proved to be particularly attractive to young scientists, who regard it as a real challenge. A youth molecular neurodegeneration laboratory was established at the Polytechnic University thanks to a mega-grant from the Ministry of Education and Science and is functioning with the support of a grant from the Russian Science Foundation. Those working there are mainly master's degree students and postgraduates from the Department of Medical Physics (headed by Olga Vlasova, Doctor of Physics and Mathematics). And the laboratory preparing our biomedical response to Alzheimer, like the master's programme, is headed by the Polytechnic University graduate Ilya Bezprozvanny, now a professor at Texas University in the USA.

Another biomedical project is the development of high-precision technology for people with physical disabilities. It is put into action not mechanically but with the aid of the neural networks in the brain. For example, the Turner Children's Orthopaedic Research Institute made a working model of a prosthetic arm for a patient. As part of the collaboration with the Vreden Institute of Traumatology and Orthopaedics a titanium prosthetic coxofemoral joint was produced on a 3D printer with the aid of additive technologies. At that time, in 2015, it was the first project in Russia to use additive technologies in the manufacture of hi-tech articles for medicine. With the aid of digital technologies the joint of an actual patient was scanned and polystyrene models were produced, on the basis of which the metal prosthesis was made. The prosthesis, which has extremely complex geometry, is made of a bio-inert material that is absolutely safe for the organism.

One could mention other groundbreaking projects which are already at the output stage, such as the creation and development of nanovessels and nanofibres, transplanted during the replacement of blood vessels and internal organs. In the very near future a patient at the St. Petersburg Clinical Scientific-Practical Centre of Specialized Types of Medical Assistance (Oncocentre) will have an operation to fit an artificial lower jaw. The prosthesis will be printed on a 3D printer at St. Petersburg Polytechnic University and modelled in accordance with the patient's anatomy.

It is no coincidence that the first biomedical centres appeared at leading world universities. The achievements of St. Petersburg Polytechnic University again show the importance of a favourable innovative environment for the formation of an interdisciplinary biomedical cluster. The designs developed here are a genuine contribution both to science and to the improvement of the nation's health. The results of the research are confidently emerging beyond the bounds of laboratories, leading to groundbreaking technologies capable of changing approaches to treatment and health care as a whole and providing full-value lives for many of our fellow-citizens – better health for the nation.

Professor Anatoly Popovich, Doctor of Technology and Director of the Institute of Metallurgy, Mechanical Engineering and Transport at St. Petersburg Polytechnic University (left), hands over a prosthesis developed at the university with the aid of additive technologies to Rashid Tikhilov, Director of the Vreden Institute of Traumatology and Orthopaedics.

Internal, External, Normal

RECTOR AND STUDENT ADVOCATE DISTANCE LEARNING

With the participation of Alexandra METLITSKAYA. Photos: the St. Petersburg State University Press Office, Kuznetsov family archive

St. Petersburg State University has around 30,000 students, and naturally Rector Nikolay Kropachev cannot meet all of them in person, but he made an exception for his namesake Nikolay Kuznetsov, emphasizing that he was very interested in conversing with him — both as a future lawyer colleague and as the pioneer of a new method of study...

Lawyers' Day at St. Petersburg State University. 1 September 2014.

First, a little history. Kolya Kuznetsov from St. Petersburg lost his sight and his hearing at the age of two and a half after a bout of meningitis. The blindness, alas, proved to be permanent, but his hearing was restored by advanced medical technology — a cochlear implant and rehabilitation at the St. Petersburg Ear, Nose, Throat and Speech Research Institute. As a six year-old boy he entered Konstantin Grot Boarding-School No.1 and graduated with a gold medal. He now speaks fluently in Russian and in English and writes poetry that is mainly influenced by music. At the age of twelve he was already dreaming of becoming a lawyer. His mother was prepared to take him to university every day and collect him at the end of lessons. As it happened, it was then (in 2014) that St. Petersburg State University introduced an internal-external form of education in Jurisprudence with the use of electronic technology, and the selection board suggested that Nikolay should try distance learning. He unhesitatingly agreed: he had already learned to use a computer in his last years at school — not with a Braille keyboard, but a special keyboard with sound. This made it easier for him to summarize lectures online or from recordings, participate in webinars, have individual consultations and take tests and exams.

On 1 September that year, as part of Lawyers' Day, the new undergraduate had his first fleeting encounter with the Rector, who wished him success. Professor Kropachev did not forget that meeting and three years later invited Nikolay and his mother for

a confidential chat in his office. One can imagine how important that was for a fourth-year student pondering on his choice of specialization in law. It is also understandable that the student listened more than he spoke, but it was nevertheless a dialogue — the clear-cut comments and questions of his young colleague prompted the Rector to replies based mainly on his extensive professional experience.

Learning that his young colleague was choosing between natural law, criminal law and intellectual property law, the Rector advised him not to immerse himself in academic study just yet but to do some practical work, especially as he already had the basic knowledge and even some experience — his classmates and his father had already consulted Nikolay on legal matters. The Rector suggested to the talented student that he try his hand at the up-and-coming field of education law in the university's legal clinic which deals with actual clients and role-play situations. And an internal-external form of study opens up these possibilities. Here is a typical excerpt from their dialogue:

Student: We have seminars in which there is no provision for internal students: in municipal law, family law... But sometime webinars and lectures coincide, so I have to listen to lectures in recordings, not online.

Rector: Then again, full-time students do not have that possibility. We record lectures especially for internal-external students. You can study at St. Petersburg State University wherever in the world you may be. One of our students was an athlete who went off to a training camp: because of the time difference he listened to recorded lectures, then competed successfully at the Winter Olympics in Sochi.

Student: The system really is excellent, though problems arise periodically with the technical preparedness of the lecturers. They have not all mastered the Blackboard distance learning system — sometimes they even need to be prompted.

Three years later.
Meeting of the student and the Rector.

Rector: That is a problem for the University as a whole, and not only for the University, though only we have Blackboard in the volume necessary for the educational process. We are gradually introducing the system into all our programmes as it improves the quality of teaching, helping to create and use methodological developments... For instance, lecturers in the management programmes make extensive use of Blackboard, and our Higher School of Management is rated 37th in the world by the Financial Times — that is partly due to the use of modern educational technologies. I hope that in a year or two the majority of lecturers in the Jurisprudence programme will also have mastered Blackboard.

Nikolay, write to Virtual Reception and tell them what technical or organizational shortcomings hinder your studies — that will make it easier to remove those obstacles. And I will continue to do all I can to ensure that school-leavers who, for one reason or another, cannot attend lectures in person, receive intensive education in one of the top law schools in the country.

Nikolay Kuznetsov has taken part in Russian Maecenas projects: he was a guest at Maecenas Day 2017 in the State Hermitage (p. 40–43) and one of the characters in the film Let the World Hear!, made on the editorial board's initiative. The film was premiered in Moscow and St. Petersburg in September-October 2017 (details on our website www.rusmecenat.ru).

By Custom at the Hermitage

WHO DONATED WHAT ON MAECENAS DAY 2017

Rodion ELISEEV. Photos: Pavel Markin, Svetlana Ragina, Evgeny Sinyaver, Timur Turgunov

The 12th Maecenas Day — a special occasion for benefactors and socially responsible companies — was held in the Hermitage Theatre. Over the years the day has become an event on a national scale with growing international input and is now a fixture in the calendar of cultural events in a number of cities, but its main venue is still the Hermitage, where the collection includes Tiepolo's masterpiece *Maecenas Presenting the Liberal Arts to Augustus* (1745). It was against the background of this painting that the symbolic birthday of Gaius Cilnius Maecenas was celebrated — on 13 April, the date calculated from a Horace ode.

The event began with a special switching-on of the famous *Peacock* clock. The ceremony in the Hermitage Theatre was opened by the museum's General Director Mikhail Piotrovsky: 'Today we say THANK YOU to everyone who does good deeds, to many people in various spheres of society. This gathering is a great example of how society should react to good deeds.'

After that Arkady Sosnov, Editor-in-Chief of the *Russian Maecenas* almanac and the initiator of Maecenas Day, introduced the charitable projects which had been implemented in the past year and their representatives who were present in the theatre.

Some donations were presented during the event and displayed in the Hermitage Theatre foyer: an elegant suite of furniture made at the Liseret Brothers' factory in 1883 — a gift to the Hermitage by the collector and antique dealer Yury Abramov, objects from the archives of the Orlov dynasty presented to the Hermitage by the Parisian collector Maurice Baruch and a monograph entitled *The Bulla Dynasty of Press Photographers: Karl. Alexander. Viktor. Yury*, containing a number of unique photographs, including one of 1917 — a gift from the Karl Bulla Historical Photography Foundation.

Two rare items — a Safavid alam (banner finial) from the second half of the 17th century and an album with watercolour drawings









Donors from the Karl Bulla Historical Photography Foundation prepare for the ceremony.

The partners of the concert part of the event were the *MED-EL* and *Baltic Leasing* companies, the Kempinski Moika 22 Hotel, the *Meeting Halfway* International Creative Festival and *St. Petersburg Concert*. Assistance in the organization of guided tours for the guests at Maecenas Day was provided by *St. Isaac's Cathedral* State Memorial Museum and *Tsarskoye Selo* State Museum-Reserve.

of both sides of the jubilee standard of the 13th Narva Hussar Regiment — were donated to the museum by Sergey Slipchenko, one of the founders of the Society of Enthusiasts for the History of the Russian Guards.

A traditional Maecenas Day THANK YOU went to the collector Mark Bashmakov, who helped the museum to acquire a Bible illustrated by Marc Chagall (105 engravings), and to the entrepreneur Sergey Girdin, whose donations form a substantial part of the Hermitage collection of African art. On that very day the Oriental Department had opened a permanent display of African art in the General Staff Headquarters Building.

Philanthropists

It was not only the Hermitage that received gifts. A set of facsimile copies of medals commemorating Peter I's military victories (including *A Russian Bomb Found its Place in Kexholm. 1710*) was presented to the Historical-Technical Museum of the Peter the Great Polytechnic University in St. Petersburg by its graduates. 'The greatest pleasure for a higher educational institution is to receive a gift from its graduates', said Academician Mikhail Fyodorov, the university's president.

An especially therapeutic gift — modern speech processors for profoundly deaf patients — was donated by visitors from Austria, Professor Erwin Hochmair and Dr. Ingeborg Hochmair, winner of the Lasker-Debakey International Prize for outstanding achievements in clinical medicine. The husband and wife team are the inventors of the cochlear implants with which Russian doctors led by Academician Yury Yanov, Director of the Ear, Nose, Throat and Speech Research Institute, who also attended the event, have returned thousands of patients, mainly children, to the world of sounds. *Russian Maecenas* described their work in detail in its previous issue.

A new culture of charitable activity is now taking shape and technologies are being developed which guarantee the transparency, stability and predictability of the good deeds of an increasing number of people. It is impossible to list all these projects, so Arkady Sosnov gave the audience a sort of alphabet of charitable activity which included the significant projects of the previous twelve months in alphabetical order.

This original anthology included the play *Oedipus Rex*, initiated by the *Ostrova* Charitable Foundation, the proceeds from which went towards the treatment of children suffering from cystic fibrosis, the exhibition *In the Same Colours* organized by the *Anton is Right Here* Autistic Support Centre, the Imperial Porcelain Factory and the State Hermitage, the *Lyona's Cat* Foundation for Homeless Animals, founded by Valery Gordin in memory of his late son, the *Endow-*

Mikhail Piotrovsky thanks Yury Abramov for his valuable donation.

Danil Pluzhnikov on a guided tour of St. Isaac's Cathedral and on stage at the Hermitage.

ment-2017 Forum (one of the organizers was the Vladimir Potanin Charitable Foundation)...

The list also included the restoration of the glazed Lyons Hall in the Catherine Palace at Tsarskoye Selo with the support of the *Transsoyuz* Charitable Foundation and a unique gift from the Pitarro family to the Benois Family Museum at Peterhof. Konstantin Sukhenko, Chairman of the St. Petersburg Cultural Committee, spoke of the importance of supporting culture and the benefactors themselves.

The concert programme which followed featured young musicians: pianist Arseny Mun, winner of international competitions and the Yury Temirkanov Cultural Initiatives Foundation prize, Aigerim Tutova (Kazakhstan), winner of the *Magical Symphony* International Competition for children with impaired hearing, who was accompanied by the *Divertissement* Chamber Orchestra (Artistic Director: Honoured Artist of Russia Ilya Ioff), and the visually impaired violinist Elizaveta Zakharova, winner of the *Meeting Halfway* International Creative Festival.

A special guest of the event was Danil Pluzhnikov from Sochi, winner of the *Voice. Children. 2016* TV show. One of the songs he performed — *They Beat Us, But We Fly* — sounded as a hymn to the courage of people with disabilities who are overcoming the vicissitudes of fate.

Domestic Pets: Cats, Dogs etc

A ROUND-TABLE AT THE ST. PETERSBURG BOOK FAIR DISCUSSED THE RELATIONSHIP BETWEEN HUMANS AND ANIMALS IN THE METROPOLIS

Sergey TEPLOV. Photos: Timur Turgunov

The 12th St. Petersburg International Book Fair was held in the city in 2017. By tradition, *Russian Maecenas* was an information partner and participant. One of the 200 events in the fair's extensive programme was the round-table discussion *Animals in the City* organized by our almanac.

The works of classic Russian writers cultivate in their readers if not love for animals then at least a caring attitude towards them. Alas, in the hurly-burly of life in a big city such truisms are forgotten and responsibility for the animals we have domesticated is being eroded. They suffer, just as innocent people sometimes do. How can the metropolis be made comfortable for all its inhabitants? This is a pressing question, and not only in the Year of Ecology. The attitude of humans to animals is multidimensional — it has economic and moral aspects and is extrapolated onto relationships among people. The St. Petersburg Professor of Economics Valery Gordin founded the *Lyona's Cat* charity for helping homeless animals in memory of his son Lyona who died in a plane crash (*Russian Maecenas, No. 25, April 2017).*

This theme was resumed at the book fair. How many pets are there in the city and how many stray cats and dogs? What rules govern their lives? Are there enough places for walking dogs? Do their owners care enough about the city environment and the safety of others? Can animals which live in yards be considered as homeless and what happens to pets which are literally orphaned when their owners die? And there is another category of animals which have become an integral part of the city's culture — remember the famous Hermitage cats.

The purpose of the round-table was not to go over all the painful points, but there was a desire to verify attitudes. Before the discussion began Arkady Sosnov, Editor-in-Chief of *Russian Maecenas*,

proposed that the participants should vote for one of two formulae: *A City for Humans* or *A City for All, Including Animals*. The second point of view won by a small majority.

As Valery Gordin, the initiator of the *Lyona's Cat* foundation, remarked, when resources are scarce there is a fierce battle for them, including among charities. At the very beginning of the foundation's existence it became clear that what the refuges which act as intermediaries for easing the tension between citizens and stray animals need is not money to feed their animals (food at least is provided by sponsors), but cages, pet carriers, traps, instruments for anaesthesia and intensive care and other veterinary equipment. There are quite a few refuges, but they all have insufficient equipment and if you give to one you will upset the others. So in line with the model of a sharing economy the foundation has established a centre for the free, unsecured hire of equipment — the first such centre in Russia. The most needed items turned out to be carriers of various types — there was a simply explosive demand for them! Of course these little veterinary delights will not solve the problem of homeless animals in the city, but they will make life easier for animal welfare organizations and ordinary citizens, the professor concluded.

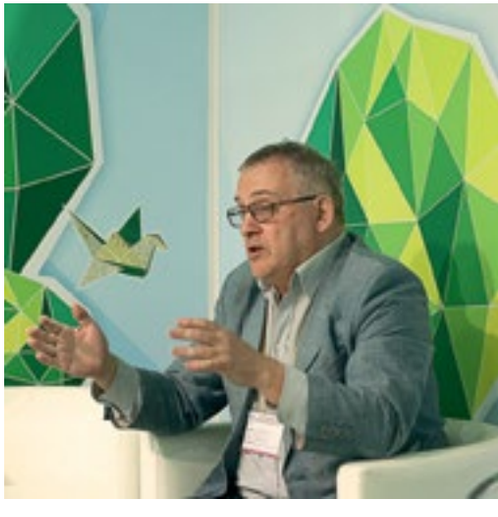
The foundation's executive director Olga Karpenok paid tribute to the partnership with the *Elvet* network of veterinary clinics, which has taken on the storage, care and issue of equipment. Its depot has a centre where one can obtain not only carriers, cages, apparatus for oxygen therapy, cat traps, ultraviolet recyclers for disinfecting the air or an infusion pump (a device for measured intravenous administration), but also instructions for their use. The conditions of issue are simple: a rental agreement is signed for a year, but only with registered refuges. The system is practical and humane: the animals suffer no stress and the refuges save money.

Anna Kondratieva, the manageress of *Elvet*, is not only a social businesswoman but also the Dr. Doolittle of the Hermitage cats. Reflecting on the culture of the maintenance of animals in the city, she admitted a desire to make St. Petersburg the ZOOcultural capital, but... According to statistics, up to 90% of homeless animals were once domestic pets. Anna frequently asks her animal welfare colleagues why they care for abandoned animals: to make their lives easier or to feel more human themselves. And she is convinced that this is interrelated. So it is good when organizations such as *Lyona's Cat* appear, since they help the people who are helping homeless animals.

Anna Kondratieva did not come to the meeting alone but with her sons and her charming Jack Russell Zhizhik, whose whole appearance showed that life was great and people were his brothers. In fact, as Anna explained, the dog was taken to a clinic as a five month-old puppy with fractured paws and a dislocated jaw. He was brought by his owner, who partly admitted his guilt in the words: 'He destroyed a family relic and I couldn't help myself'. This puppy of a hunting breed, with metal pins in his paws, spent nearly two months after the operation against his will in a cage provided by the foundation to restrict his movement. After treatment the terrier was

Valery Gordin (right) believes that 'the city is for all'.

Arkady Sosnov opened the discussion.



The *Cats' Republic* refuge in St. Petersburg.

A bill concerning the responsible treatment of animals will become law before the end of 2017. It is one of the priority initiatives declared by Alexander Zhukov, Deputy Speaker of the State Duma, and is one of the most hotly debated documents in recent years. It passed its first reading as early as 2011, but, owing to differences of opinion within the Government, which could not decide which department would supervise the matter, the bill was held up in the chamber for six years. By its second reading the bill had been completely rewritten and had undergone over three hundred amendments. The final version, according to its writers, pursues two principal aims: reinforcing morality and a humane attitude to animals in Russian society and increasing the safety of people in their treatment of animals.

Parliamentary Gazette, 29.09.2017

returned to his owners, but a month later the poor devil was back in the clinic, after which he finally found a new reliable family — it is a plot worthy of Chekhov or Gavriil Troepolsky...

'Nevertheless the city is primarily for people and their comfort', insisted Yury Marasanov, a member of the St. Petersburg Government's Social Council on Matters relating to the Treatment of Animals. 'We all like animals to one degree or another, but in some that love is hypertrophied, which causes inconvenience to others. Every year in St. Petersburg 6,000 to 8,000 people are bitten, including children, and that is unacceptable. Pets are an integral part of the city environment and naturally the right conditions for them must be created. However, there are only a little over twenty special areas for walking dogs and about 250,000 pet dogs. By way of comparison, Helsinki has around eighty dog parks.

Our dog owners walk their pets almost anywhere: in gardens, parks and children's playgrounds, ignoring the *Walking of Dogs Prohibited* signs, thinking that this is an act of humanity in respect of animals, even though it impinges upon the interests of another section of the population and breaks laws and rules. There are eighteen districts in St. Petersburg, all with their own specific conditions; for example, there is virtually no space left for such areas in the historic centre and in each case it is necessary to institute a dialogue with the public and seek compromises, I emphasize again, in the interests of all citizens'.

Entering into the discussion, Yury Andreyev, Head of the St. Petersburg Veterinary Authority, immediately introduced an amendment: there are no *homeless* animals in the city (the term had been used by all the participants): there are *stray* animals, some of which are happier than they would be cooped up in a flat — yard animals, for example, who are cared for by kind, often lonely people. The city is a large home for all animals, which are part of its property.

Andreyev quoted interesting statistics to demonstrate the diversity of this property. Besides the 250,000 dogs already mentioned (plus no more than 7,000 strays) and around a million house cats, there are 1,300 horses in the city, as well as a certain number of cattle, sheep, pigs, goats and rabbits. The ways of people showing their love for animals are sometimes quaint: for instance, there is a society of pet rat lovers who lobby against the extermination of rats...

Yury Andreyev is absolutely convinced that the most important factor in man's treatment of animals is the education of the younger generation. Adults have to be informed of the rules of behaviour in this field and the negligent ones forced to abide by them and to educate their children — to base their teaching on the best examples from Russian literature and explain clearly, in Mayakovsky's words, *what is good and what is bad*.

Valery Gordin eagerly took up the idea of education. Not for nothing is one of the programmes of the *Lyona's Cat* foundation a mobile exhibition called *Friends*. Schoolchildren and adults draw animals, mainly so that their pets can be portrayed — for example, granddad with a kitten that he found in the street.

From what age can this love — face-to-face or at a distance — be instilled, taking into account the fact that an animal might





scratch, bite or cause an allergy in a child? Anna Kondratieva told us that a School of Caring Owners has been established under the auspices of the Cat Museum (another one of her projects) and that those who attend lessons are primarily couples preparing for the birth of a child. They acquire a cat or a dog and learn to care for it. As far as the possibility of a baby and a pet coexisting in a family is concerned, the stereotype has formed that 'with the birth of the child it is necessary to get rid of animals', and this has to be overcome. Communication with an animal is undoubtedly good for a child — it is merely necessary to choose appropriate forms of communication and observe rules of hygiene.

Viktor Golos, adviser to St. Petersburg Vice-Governor Anna Mityanina, reminded us that at the end of every dacha season the refuges fill up with lots of abandoned strays, though their former owners surely know the quote from Antoine de Saint-Exupéry concerning their responsibility for their pets.

But what can be done about this? Not to spare any effort, telling both state bodies and social organizations to promulgate ecological education. Furthermore, it is naive to suppose that all the problems will be solved with the adoption of the Federal Law on the responsible treatment of animals, but it will make it easier to work with them.

Disagreements are inevitable, but mutual understanding among those involved with animals was achieved in St. Petersburg quite a long time ago, Yury Andreyev assured us. All the critical matters are under discussion, none of them are being hushed up, including the formation of a Public Council under the auspices of the St. Petersburg Government.

'My children, my grandchildren and I adore walking with the dog through the city. It is excellent therapy, education, what have you. Alright, is it considered to be *walking our property*?' — added in surprise the publisher Boris Pasternak, who has a subtle feeling for words. But he has been reassured: of course your dog is valuable property, isn't it? You are also responsible for ensuring that it does not cause inconvenience to others. Consensus was also achieved on this point.

A rerun of the vote on the question whether the city is for people or for all its inhabitants revealed an equality of opinions, but... Zhizhik had the casting vote. May we be successful in establishing harmonious attitudes to animals, as world literature teaches us!

At the round-table discussion: Olga Karpenok, Yury Marasanov, Anna Kondratieva, Boris Pasternak, Yury Andreyev and Viktor Golos (below).

Visitors to the *Russian Maecenas* stand (from top): Valery Leonov, President of the Russian Academy of Sciences Library, Victor Novikov, Artistic Director of the Komissarzhevskaya Drama Theatre, a fan of Joseph Brodsky's work.

City of Readers

AT THE 12TH ST. PETERSBURG INTERNATIONAL BOOK FAIR

Photos: Timur Turgunov