The HSE LOOK

TECH HUB HSE

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‘I do not fear computers. I fear the lack of them.’
— Isaak Asimov

Data is crucial for scientific research, be it physics, mathematics, IT security or statistical genomics. And HSE Tikhonov Moscow Institute of Electronics and Mathematics (MIEM), which has been part of HSE University for the last 10 years and celebrates its 60 years of pioneering research next year, has it all. With that in mind, we will start this issue with a very brief overview of MIEM’s development followed by an interview with Eugenii Krouk, Acting Director of MIEM since 2017, who kindly agreed to talk about how he got to HSE University, the changes he has sought to implement and his vision for MIEM’s further development. In addition, he identifies several core areas of research - wireless networks and information transfer, the physics of new materials, quantum methods and technologies, information security, mathematical modeling, statistical and computational genomics. These subjects are further elaborated upon by leading researchers from MIEM. This issue’s ‘Discovering Russia’ column features Dr. Frank Fischer and his thoughts on things one cannot do when they are not in Moscow. The current issue also includes its own supplement – a welcoming introduction of newly internationally recruited staff, as well as reflections on motivations to prolong contracts with HSE University of those who plan to stay with us for several more years.

Yulia Grinkevich
Director for Internationalisation

MIEM, or the Moscow Institute of Electronic Machine Building, as it was called in 1962, was established by the decision of the Central Committee and the Council of Ministers of the Soviet Union for the purpose of training specialists for the needs of the State Committee for Electronics Technology. Within the next two years, MIEM became one of the most competitive academic institutions in Moscow with enhanced studies of mathematics that led to the opening of the very first faculty of applied mathematics in the Soviet Union which trained engineers/mathematicians.

To keep up with the times, in the 1990s, the institute started teaching information technologies and, as such, new specializations were introduced - computer design and advertising, cyber-security, quality management, information and ccommunication technologies and systems, biotechnical systems and technologies, nanotechnologies and microsystem engineering. In the same year, the institute was renamed as Moscow Institute of Electronics and Mathematics (MIEM). Later on, leading developers of software and telecommunications equipment – Motorola, ZyXEL, Synopsys, MentorGraphics – opened authorized centres at MIEM. In spite of all this, student enrollment at MIEM dropped by over 50 percent from 1990 to 2010 owing to various problems, ranging from the poor quality of student intake to unfilled state-funded places. By the end of 2011, MIEM was incorporated into HSE University by the order of the Russian Government. From 2012 until his untimely demise in 2016, Alexander Tikhonov was the Director and Academic Supervisor of MIEM.

THE KERNEL

'Our distinction is our core areas of research'

***Evgenii A. Krouk** became the acting Director of the HSE Tikhonov Moscow Institute of Electronics and Mathematics in 2017. Before joining HSE University, he served as Dean of the Faculty of Information Systems and Information Security and Vice Rector for Science and Innovation at Saint Petersburg State University of Aerospace Instrumentation (SUAI).*

Why did you decide to move to HSE University?

Indeed, it was a rather strange decision for a middle-aged person with an established life that even would include a slight demotion. Nevertheless, I realized I accomplished everything I could at SUAI - a place where I had already studied and worked on and off - and would not be able to move any further despite the powers I had as a vice rector (for various objective and subjective reasons). Furthermore, HSE University seemed to be the place where there was a lot I could try to do. I had an impression that it has been the leader of enlightened education beyond the purview of the Ministry of Education and, thus, many processes and initiatives, which would be simply impossible at other universities, could be realized here.

There were two things I wanted to do in life education-wise - to organize a research institute and establish an institution of tertiary learning of high quality. Even though the research institute had already been organized by that time, its standing as an establishment of higher education was yet to be achieved. Despite my age, I decided to challenge myself.

MIEM was undoubtedly one of the elite technical institutions during the Soviet era, but it started to decline in the 1990s for a very simple reason - it was always oriented towards Moscow-based students (it was for this very reason that MIEM did not even have a dormitory). In the 1990s though, they largely started to turn to humanities, and student enrollment at MIEM dropped by more than half. It's not a secret that academic institutions rely on student intake; they cannot survive only brilliant professors but no students. MIEM started to decline and its merger with HSE University, though a natural progression, was quite an audacious decision of Aleksandr Tikhonov and Yaroslav Kuzminov.

Yaroslav Kuzminov, of course, was able to take a long-term view. Our ideas of what can and should be done were very similar. My only request was freedom for decisions regarding MIEM. Seeing my hesitation, Yaroslav Kuzminov suggested that I audit the institute and recruit personnel myself. During that period, I met and talked to most of the staff. It didn't matter whether I was an employee or not, I acquired a feeling for the place before accepting the invitation to join MIEM and getting fully involved in it. The two institutions had very different organizational cultures - MIEM was a closed university with a family atmosphere that aimed at training people primarily for domestic needs while HSE University has been open, contemporary, and in pursuit of global standards. Even MIEM's specializations were completely out-of-date. Although they featured modern titles, the content was inconsistent with reality. I read publications authored by all of its staff members and talked to the majority of them during my transition so that I could understand what they were doing. The rest turned out quite naturally.

What were the priority changes that you sought and what has been achieved?

One of the major strategic changes has been the introduction of a project-based learning so that students gain practical experience from real projects. I was talking about this 25 years ago as I saw it taking shape at Western universities, but what we have created (and all credit here goes to my colleagues) is much better.

There are two inconsistent trends in the training of today's engineers that we have had to consider. On one hand, the IT sphere is changing at a dizzying speed and having deep theoretical knowledge is no longer enough. Companies do not have time to teach graduates. In the IT sphere, employers take you seriously only if you already possess technology knowledge and skills. How to teach that in university? Only through project work. On the other hand, though technologies change rapidly, the products created with these technologies have a longer lifespan - and their modification and repair require an understanding of how things work. Thus, it is not enough to only possess the technology knowledge, you need to know how technologies have been evolving, and this requires fundamental theoretical knowledge.

MIEM was one of the first HSE faculties where project-based learning became an integral part of the educational process. Nowadays, almost all undergraduate and graduate students of MIEM are involved in it, with the exception of first-year undergraduate students. Education is built around project work, not the other way around. In order to ensure this, we had to select projects very carefully to be sure they come from students, not teachers. Within this framework, students eventually have to take courses on mastering new skills and technologies. Formed teams must progress from an initial idea to a minimum viable product, and every project should eventually end up with a working prototype.

In order to manage such a large number of projects, it was necessary to code a system – extensively in regards to the efforts of students and several software engineers - that would allow us to track each student on every team. The system made a profound impression on me and it still amazes all clients who gets to view it. The moment they see the statistics the system provides for each project participant, they immediately become either our friend or a business partner.

Furthermore, all of these efforts have impacted on students' interest in MIEM (the total number of applications went up from 3,671 in 2020 to 8,261 in 2021), followed by a subsequent increase in overall enrollment (over 600 students in 2021) - it was a madhouse this year!

What else, besides project-based learning, distinguishes MIEM from the other scientific faculties at HSE University?

Our core areas of research! First of all, this would include wireless networks and information transfer. This is an area where we undoubtedly possess expert knowledge and top expertise (at least in Russia). Another field is applied electronics, which has always existed at MIEM, but has lagged behind due to the lack of proper laboratory equipment. Furthermore, physics of new materials, quantum methods and technologies, which is researched by the Quantum Nanoelectronics Laboratory. Computational physics, which is associated with the supercomputer facility that HSE University currently possesses, is quite a unique field as well. Also, our competencies in such fields as information security and post-quantum cryptography are developing quite rapidly. There is a strong risk of losing data protection owing to quantum computing and its associated algorithms, which affect the stability of all systems we now employ. There are not many alternatives for data protection, but I am sure that one of the approaches tested at MIEM - though not identified as the only main method - is correct. Our mathematical modeling has been quite successful as well. Another strategic area of development is the convergence of information technologies with biotechnology. On the one hand, this covers mathematics and mathematical modeling, but on the other hand, it also includes a relatively new field - statistical and computational genomics.

What are your plans for the future of MIEM?

We need to focus MIEM on large applied projects, which can be visible nationally. On the one hand, this is generally the goal of any engineering university, i.e., reaching a national level of visibility. On the other hand, this is very much related to project-based learning in our graduate programmes, where its effectiveness is still quite average. Our Master's students are adults - some of them already have families and need to support them financially; most of them are employed. Therefore, additional projects at the University can be a burden for some of them. The only solution I see is to attract large projects/orders from outside so that our Master's students can work at the University. For this reason, we started forming proper subdivisions within MIEM (science and technology transfer centres). We also plan to participate in state tenders for the creation of engineering schools. Nonetheless, it will be difficult to compete, as our competitors are quite serious. Still, we need to reach this level with large projects and major industrial customers. For instance, we really hope to start cooperating with Sistema, as its founder Vladimir Evtushenkov has contributed to the development of MIEM.

Wireless Networks and Information Transfer

Evgeny Kucheryavy is a Professor at the School of Electronic Engineering

Why are wireless networks important?

Wireless communication is the pillar of future development of IT, as almost all devices today are wireless - mobile phones, cars, laptops, headphones, etc. With this huge number of devices that we already have, and their number continues to grow, it is not so easy to make them work simultaneously and provide services that end users want to have. Wi-Fi has already reached commodity status, just like clear water and electricity. Without it - if we are bound to something with a wire - no services can be provided. We would not have entertainment centres in our cars, or watches with our health stats. Without wireless communication, we would be nobody in terms of the next step in human development.

What kind of research do you conduct at MIEM?

My focus is the effective operation of wireless channels and transmission systems in general. Our main task is to ensure that large amounts of data, which is consumed by a huge number of new and old devices, can coexist throughout wireless channels and be easily sent and received by end users. Consumers now include not only people, but also industries, which have historically had a great number of super-expensive automation systems - both in development and deployment. For example, there is this trend with the 'Internet of Things', moving towards the replacement of large numbers of wire sensors by wireless sensors. With respect to production processes - if wireless sensors fail to work properly and there is late delivery or loss of some data - this might bring conveyors to a halt, the downtime of which can cost millions of dollars. This also concerns data security, but this is the expertise of my other colleagues at MIEM.

The research we do is both theoretical and practical, depending on the project we are working on. There are academic projects sponsored by funds that require theoretical knowledge on how new solutions and technological improvements affect the Internet of Things (e.g. whether a new channel for data transmission is energy efficient). We also carry out mathematical modeling and identify variables. Then, we approach developers and help them figure out how products they want to bring to market in a few years will actually work. New protocols and technologies can further be applied to physical prototypes, tested, refined in terms of algorithms and adjusted to needed parameters. We do R&D work for companies (vendors, equipment manufacturers, etc.,) that ideally leads to the creation of new equipment. Sometimes, these developed technologies can be commercialized as separate products.

What are your plans for the upcoming academic year?

Writing and publishing articles together with my students. A good strategy is to write a scientific paper with a student and teach them the process through editing the work. This can be rewarding later, when students start writing articles by themselves. This year, our goal is to publish three to four Q1 articles. It is important to work with students; otherwise, there will be no team, no accomplishments, no success.

Another goal is to work on industry projects, which is crucial for an applied area like ours. A large number of state sponsored projects are being implemented at the moment, and this is quite a positive development in recent years. Moreover, this absolutely fits into the principle of project-based learning adopted by HSE University.

Physics of New Materials, Quantum Methods and Technologies

Andrey Vasenko *is a Professor at the School of Electronic Engineering and Deputy Head of the Quantum Nanoelectronics Laboratory*

What kind of research in new materials is being carried out at MIEM?

The development of new functional and quantum materials is a rather evolutionary topic, which has brought together a group of scientists from all over the world at MIEM. We work not only on materials, but also on computational methods.

One of the research areas we are considering is materials for solar energy harvesting. Although silicon power engineering is developing well, its efficiency remains rather low (at only 10-20%). Nevertheless, one of the materials that enhances efficiency is perovskite, which, in fact, is a complex crystal structure, typical for a wide range of different materials (e.g., certain high-temperature superconductors are also perovskites). Perovskites are functional materials, which means that their characteristics can be tailored. By changing the thickness of a perovskite layer, for instance, we change its ability to receive photons of different spectra and thus can produce a combined metamaterial structure, which can absorb solar energy very efficiently. Perovskites are very cheap to make, but batteries made of them have a shorter lifespan. The industry is improving, but not as fast as we would like it to. Silicon energy is also emerging and there is still no compelling reason to replace it, but perovskites definitely qualify for solar materials owing to their high performance and low cost. Perovskites have many other applications – they are also used for photocatalysis and in the construction of photodiodes, as well as for energy and emerging (quantum) technologies in general.

Computational methods for studying perovskite properties have been developed recently. We combine the time domain density functional theory (TDDFT) with non-adiabatic molecular dynamics (NAMD). Furthermore, density functional theory (DFT) provides a rigorous and efficient description of both the material electronic structure and ionic forces. The atoms and electrons are described by Newtonian andSchrödinger equations. We simply set the coordinates of the atoms, and the supercomputer at HSE University automatically calculates the characteristics of the materials. TDDFT is an extension of DFT in the presence of time-dependent potentials, such as electric or magnetic fields, or atomic motions. This is a promising field, which is currently being developed at the University and can benefit from a productive scientific collaboration with a research group from the University of Southern California. We also have a postdoc from China who has recently joined us.

Another area of our research includes the study of realistic perovskite structures, where novel aspects associated with chemical details emerge. Some important questions include how the presence of water on the surface of a given material changes its ability to absorb solar energy and what percentage of surface or structural defects is acceptable (it was found that a certain number of defects actually enhance efficiency). With other new materials, we take existing perovskite structures, change certain parts and check if that will lead to an increase of efficiency. It works - in some cases it turns out that replacing one halogen atom with another can produce greater efficiency and oxidation stability.

We also work on superconductivity and superconductors, which are functional materials as well. We artificially bring together different materials that would not otherwise interact. For example, superconductors are combined with ferromagnets and we can generate hybrid structures with unique properties. One of the materials that we came up with while working with superconductors is the topological insulator. It behaves as an insulator in its interior, but the surface contains two-dimensional conducting states (i.e., it is like a piece of wood covered with foil, but as one single material). This new state of matter appears due to very strong spin-orbit interactions. In addition, very unusual electronic states (so called 'Majorana fermions') arise in hybrid structures consisting of superconductors and topological insulators. For example, Microsoft even decided to use them in their development of a new type of computer - a topological quantum computer.

We have many strong scientists working with superconductors and superconducting metamaterials at MIEM as they give rise to emergent quantum nanoelectronics. Evgueni Chulkov, a part-time senior from the University of the Basque

Country, and Alexander Golubov, a part-time senior from the University of Twente, are currently working with us on the topic of superconductivity and topological insulators. We also cooperate with the Center for High-Temperature Superconductivity and Quantum Materials (V.L. Ginzburg Center), headed by Vladimir Pudalov, where state-of-the-art experiments are conducted. Our students can access core research facilities of this centre. Moreover, we recently applied for the opening of an international laboratory together with Francois Peeters from the University of Antwerp, who is one of the world leaders in materials science. I truly believe in team-based research and that progress in research is being carried out through collaboration with experts from around the world.

Information Security

__Fedor Ivanov__ is an Associate Professor and Senior Research Fellow at the Department of Cyber-Physical Systems Information Security

What is the specificity of information security as a direction of education and research?

We focus on those aspects of mathematics that are closely related to communication and information theories as well as the theory of data transmission, storage and processing. There is difference between secure data processing in information security and cryptography, and we take this into account in our educational programs and research. In addition to mathematics, our students study applied disciplines – systems and software engineering, security of telecommunication systems and networks – which combine fundamental mathematics with modern informatics (including a lot of programming languages) and show how theory meets practice in terms of information protection. Thus, we are primarily focused on training “civilian” information security professionals with a deep knowledge of modern telecommunications technologies and standards, and who are ready to deploy, update and even create secure information systems of various scales.

We actively encourage the development of students’ interest in science through organization of seminars that cover both classic problems as well as completely new approaches in telecommunication technologies. As projects and term papers of student have to correspond to current agenda in telecommunications and information security, such an approach allows to widen their horizons and touch upon the “adult science”, and perhaps understand that science is what they want to do in life. I am convinced that it is only the alignment between basic science and modern technologies that can lead to a “technological breakthrough”, especially if it concerns such a complex and science-intensive field as information security.

What kind of research does your department carry out?

Our department is quite young; it was formed in 2019 and so far, the team is not that big, although our research interests are rather wide. Our telecom group is engaged in both fundamental and applied research in regards to contemporary error-control coding systems – low-density parity-check codes (LDPC), convolutional and polar codes. Our team proposed a new low-resource algorithm for decoding polar codes, which today surpasses all known analogues in its complexity and efficiency. It should soon be published in a high-ranking IEEE journal. We also do research on effective decoding algorithms, including those based on neural networks, and have already received new outcomes, which we will definitely publish and patent in the near future.

Over the last two years, we have become engaged in research on post-quantum cryptography. It has been proven that the algorithms that are currently used in the banking sector – asymmetric encryption algorithms, digital signatures – will be immediately compromised as soon as sufficiently powerful quantum computers appear. Although the prospect of quantum computers’ emergence is rather distant, a potential vulnerability within such systems already exists. Therefore, we are developing methods that will encrypt data based on the assumption that quantum computers are a given (one of the existing ideas is the McEliece cryptosystem). However, the main problem of code-based cryptographic systems is the large length of cryptographic keys. Thus, the efforts of most researchers are aimed at reducing it to the length of conventional algebraic cryptosystems. Our team proposed a new approach, which is based on a fundamentally new key structure. It was already presented at EUROCRYPT 2020, one of the leading conferences in cryptography, and attracted considerable interest in the scientific community.

Another branch of our research are digital watermarks and steganography. The lead researcher in this field is the head of the department - Oleg Evsyutin. Digital watermarks are used to copyright digital content. They can check the ownership of a copyright or hide certain data in digital content that would let one say that a certain file or video belongs to a certain copyright holder. Oleg Evsyutin is also researching digital steganography, or covert data transmission through pictures - although they do not visually differ from the original ones, the modified pictures can transfer some hidden data. This type of unnoticeable data transmission is used when it is impossible to create a secure data transmission channel. These all are a part of information cybersecurity.

Moreover, we are engaged in commercial specialized application projects concerning fifth generation (5G) communication standards, and soon we will be looking at prospective 6G standards. Since some tasks require knowledge of physics, especially with respect to 6G+, this imposes restrictions on data transfer rate and may cause certain delays in the programming. Nevertheless, certainly, it is very useful that MIEM has excellent specialists who are engaged in research on quantum transmission. Through our commercial and industrial projects, over the past year, we have submitted two patent applications and they are currently being reviewed by respective offices.

Is research the only activity the department does?

The department also runs Bachelor's and Master's programmes in the field of information security. The undergraduate programme trains specialists who can operate existing systems and, in some ways, improve them. Some of our current students are already employed in the banking sector and consulting agencies while others have turned to AI and computer vision. Our graduate programme prepares specialists who are engaged in research and thus able to not only perform deployment of information security systems at enterprises and ensure data security, but also see what can be qualitatively improved in those systems, or even create new ones. Since we have strong connections with industry, our students engage in commercial research for large telecommunications firms. Thus, we are primarily focused on training 'civilian' information security professionals with extensive knowledge of contemporary telecommunications technologies and standards, and who are ready to deploy, update and even create secure information systems of various scales.

Among our immediate plans is to go global and launch joint English-taught educational programmes in information security for international students. Apart from that, our staff are involved in a large number of continuing education programmes, which are in high-demand on the part of various external clients.

Mathematical Modeling

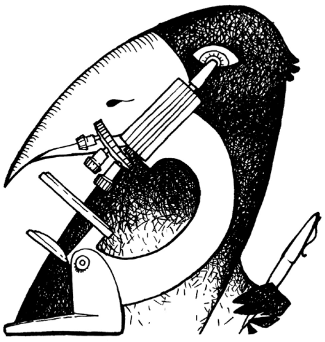
Sergey A. Aksenov *is Deputy Director of MIEM and Associate Professor at the School of Applied Mathematics*

What is mathematical modeling and where is it used?

Mathematical modeling is one of the most powerful tools that provides insights into fundamental scientific problems and allows for respective solutions. So, I would say it is used everywhere. A mathematical model (of a system or an object) provides its formal description in the form of equations, which are then used for the analysis and prediction of its behaviour. Sometimes, the equations that comprise a mathematical model are very hard to solve, so they require new mathematical or computer methods. The field that seeks such methods and models is called the applied mathematics, and the faculty of applied mathematics at MIEM is the oldest in the country – it was opened in 1968, so we have a tradition that we can rely on.

MIEM's scientific agenda is concentrated around cyberphysical systems including such fields as electronics, wireless communications, cybersecurity and machine learning - all of which require reliable and effective mathematical and computer models. Of course, we are not restricted by these areas only. For example, we operate an international laboratory that focuses on mathematical and computational methods for genomic data analysis. In one of their latest research projects, our colleagues investigated the ways the coronavirus penetrated Russia. They discovered that SARS-CoV-2 was brought to Russia from Europe between late February and early March 2020. How did they do this? Through an analysis of coronavirus mutations and the building of evolutionally trees relying on computer simulations based on mathematical models.

Mathematical modeling is a very broad field and its approaches and methods can vary greatly. With the development of computer technologies, numerical methods started replacing analytical ones in many areas and, as such, computer simulation is often used instead of mathematical modelling. Computer methods allow us to combine a variety of simple objects, make them work together, and, by doing so, discover new properties of entire systems. An artificial neural network is a good example as it consists of very simple mathematical objects combined together and becomes something new, which can be trained to win a chess champion. Another example is the atomistic simulation and multiscale analysis, and we also have an international laboratory in this field. The idea is to construct a mathematical object modeling an atom and use the computer to create a bunch of its instances, and make them interact. There exists a software that allows setting patterns of interaction between atoms and thus building a material from those atoms; we then can watch how it behaves under different conditions. Using this approach, our colleagues were able to calculate the melting point of graphene. As the melting temperature is very high and it is very complicated to try it experimentally, the computational methods allowed them to construct such estimates. Similar atomistic methods are used in chemistry and biology to predict material properties and chemical reactions. Though mathematical modelling does allow constructing many systems and processes, we cannot simulate everything. There are still a lot of unsolved problems requiring new models, methods and algorithms.



Statistical and Computational Genomics

Vladimir Shchur is the Head and a Senior Research Fellow at the International Laboratory of Statistical and Computational Genomics

What does the Statistical and Computational Genomics Laboratory do?

Genomics is one of the most promising types of contemporary interdisciplinary science. We are interested in a variety of problems related to the study of genomes, primarily the development of new mathematical models and methods for genomics data analysis (at present, we rely on probability theory, statistics, machine learning and numerical methods).

We are interested in the history of population development and interaction: traces of genetic bottleneck (events when there was a significant decrease in population size e.g., when a small group of our ancestors left Africa, and their descendants settled throughout the rest of the globe) and traces of ancient introgression (the mixing of populations e.g., inbreeding of Neanderthals and Denisovans). For example, we started a joint project with our Chilean colleagues on traces of natural selection in their genes.

A lot of research is being done on the coronavirus, and this concerns how virus populations develop within human populations. As we have a large array of data, we work on methods to predict potential variances of concern with respect to viral spread rates at the DNA level. We develop large genealogies of the virus and then look at its different evolutionary properties. Since this research involves working with data, certain projects concern how to process it. The sequencing technologies are imperfect. With this in mind, it is necessary to come up with preprocessing and analysis methods for data after it has been sequenced.

What are some of the practical benefits of the laboratory's research activities?

In the case of coronavirus, we are learning how to detect new variants as early as possible. For example, the earlier we can detect that a certain variant has an increased rate of infection, the earlier we can recommend paying special attention to it. We also analyze the effectiveness of restrictive measures (e.g., the closing of borders), which, in turn, can be used to reduce negative economic effects. Such studies require new methods. We recently developed a viral genealogy simulator, which operates as a tool for method validation. It is flexible enough to take into account many important complexities for modeling the spread of COVID-19: population structure, interacting genetic variants and cross-immunity.

As for the study of human populations, we all wonder who our ancestors were. It is a basic human curiosity. Furthermore, we want to build the most complete and accurate picture of the world so that we can analyze the processes of adaptation and consider what mechanisms of natural selection were involved throughout history. When there is an understanding of these mechanisms, we can better understand what is important in our genome and what is not. One gene can affect several traits - neutral or those under natural selection - and they can be complexly connected. If we figure out how to untie this tangle, our understanding of genetic disease and other phenotypes will largely improve. I personally would like to work with oncology. Tumors are also a population (of cells) that develops, and the process of chemotherapy acts similar to a natural selection. I am also interested in how to personalize the use of drugs and treatment tactics based on evolutionary studies of genetic tumor genetic variation. Maybe someday we could get further engaged in such research with the Faculty of Biology and Biotechnology.

What are you proud of laboratory-wise and what are your plans for the upcoming year?

I am proud of our research team, which is currently being formed. If the first year of work was under a super manual mode, now I can say 'guys, please count this'. We have around 20 students working with us who say they did not initially think that scientific work was so interesting but now want to continue to do science. There is a stereotype that it is impossible to earn enough money in science, but when our students start creating something, they then understand everything is possible. Those students, who stand out, get to work as research assistants - some get involved through project work, and others through thesis papers.

For the upcoming year, we are planning several research projects (possible intersections of interests) with the Faculty of Biology and Biotechnology, but I am not ready to talk about the details yet. I hope that something will come about soon. My other personal goal is to educate specialists for the laboratory, since this field of science is quite new. Right now, we mainly work with mathematicians.

Discovering Russia - Moscow Imaginations

The HSE Look is restarting a column about life in Russia, what can be discovered in its various cities, and interesting venues at HSE University and beyond. If you have an interesting experience to share, please contact us at: look@hse.ru. In this issue, we present a column by ***Dr Frank Fischer***

There are many things you cannot do when you are not in Moscow. During the height of the pandemic, I had to spend several months za rubezhom (abroad), where there are no mushroom forests, according to Buzykin's neighbour in my favourite Leningrad-set movie, Autumn Marathon. And so I started an imaginary list of things I would have done in Moscow if 2020 had not taken that turn.

I would have walked the boulevards, probably listening to some Russian indie pop and, almost without realising it, would have gravitated towards my favourite monuments, young Pushkin at Metro Baumanskaya, Krylov at Patriarch's Pond, Griboyedov on Chistoprudny Boulevard.

If friends had visited me, I would have introduced them to a Soviet-style Ryumochnaya, and if they had never been to Russia before, they would have taken photos with a shot of vodka in their hand and a Soviet flag in the background.

I would have gone to a midnight mass at Easter (hi Anne, hi Nastya). I would have arranged to play squash with a Swiss friend in a court at Prospekt Mira, trying to win at least one game against his impressive agility (hi Fabian).

I think of Winzavod, and the enormous factories hosting art exhibitions, three-kiss greetings, shoe mountains on guard next to padded doors and intense discussions in kitchens (hi Olya, hi Borya, hi Craig, hi everyone). Also, but for the pandemic, V-A-C would have opened the enormous doors of GES-2 on schedule, 40,000 square meters of Renzo Piano-designed art space.

After work, after an evening colloquium, I would have accompanied some colleagues to the Armenian restaurant next to the Yelokhovo Epiphany Cathedral. We would have strolled to Drunk Punk, a craft beer bar in the Arma complex near Kurskaya Metro Station, for Friday Beer, a tradition we inherited from our Danish colleagues who visited from Aarhus.

I would have enjoyed the best Georgian food outside Georgia (hi Anya, hi Seth, hi Stefan). I would have gone to a concert or two at the Moscow Conservatory (hi Sveta).

I would have spent a day at a friend's anti-café in Yugo-Zapadnaya, overlooking the city from the 28th floor (hi Elizaveta). I would have gone to the theatre to see a Pushkin play or an adaptation of a Chekhov short story (hi Nastya, hi Zhenya).

I would have left town to accompany some friends to their dacha. I would have left again, because you have to leave Moscow sometimes, for a short trip to Tula, or Nizhny, or Kazan (hi Danya). In winter, I would have headed two hours south of Moscow to ski through villages (hi Kitty). I would have left for a conference, maybe to Krasnoyarsk (Siberian Federal University is pretty strong in my field). I would have gone to Leninka and bumped into a colleague, and then we would have gone for an impromptu dinner at Kvartira 44 or Proliv on Nikitsky Boulevard (hi Marina, hi Kirill).

I would have participated in a Summer School at HSE's Voronovo Study Centre south of Moscow. I love this site, just a stone's throw away from Evdokiya Rostopchina's mansion, where she wrote, among other things, Nelyudimka, one of the best plays ever written.

I would have probably heard that one of my favourite places closed down, as always happens in Moscow. I would have watched a random ice hockey game at a bar. Between November and March, I would have spent much time ice skating in Gorky Park or VDNKh (hi Zhenya, hi Sveta, hi Tanya, hi German).

But now for the last item from my list that I would like to mention. If I had been in Moscow in the spring of 2020, I would have met with Aleksey; — and this is also the point where the 'would have' story turns into a real story. Because in the meantime I have returned to Moscow.

Shortly after the pandemic began, we encountered Aleksey in a forum which we were sifting through for missing issues of Russkiy Pioner, our favourite literary magazine edited by Andrey Kolesnikov, of which 103 issues have been published since 2008. One can download every issue online, but my friend Josik and I still afford ourselves the luxury of collecting at least one material thing, in our case every issue of Russkiy Pioner. We actually already own all of them except for the very first three from 2008, and when we paid a visit to the editorial office some two years ago, they did not have them in stock either.

Now, the aforementioned Aleksey told us that he had issue 2 of 2008 and wanted 150 roubles for it. He would hold it for us until we returned. So, after just about a year, combining one item on my list with another, I asked him to meet me at the monument of young Pushkin, just outside Baumanskaya Metro Station. On a sunny day in May, I positioned myself in front of the bust of the poet-to-be, and then Aleksey showed up, a smiling forty-something Muscovite, at 14:00, precisely on time (probably the first time this has ever happened in Moscow), and handed over the coveted issue.

And now, before I cross off another item from my list, probably Georgian food, I would like to take the opportunity to ask all the readers of The HSE Look if they know someone who knows someone who owns Russkiy Pioner issues 1 and 3 from 2008 and would be willing to enter into negotiations. Meet me at one of the places mentioned above, or in a mushroom forest of your choice.

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