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1. ROBOT-ASSISTED SURGERY

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Robot-assisted surgery is widely used in many fields of medicine, including urology. This research (based on RAS plenary presentation from November 14th 2018) discusses advantages and disadvantages of robot-assisted operations, provides statistical data concerning the number of installed robotic systems and annually performed procedures in Russia and worldwide. Possibilities of robotic training, ways of furthering surgical robot development as well as perspectives of innovative Russian robot-assisted systems are also presented and discussed.

Key research themes: robot-assisted surgery, surgical robot, radical prostatectomy, prostate.

PROPOSED COLLABORATION

Indian based Research Activity-Dr.Chitra Sarkar,Dean

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Name of Institute-All India Institute of Medical Sciences, New Delhi

Collaboration type-Lab to Lab

2. SMART TECHNOLOGIES AND ROBOTIC MEANS IN AGRICULTURAL PRODUCTION

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A necessary condition for a sharp increase in production is the introduction of digital smart technologies. With the use of digital technologies, it is possible to achieve a significant increase in labor productivity and crop yields, reduce energy and material costs. Digital machine technologies

should be used in crop production, animal husbandry, power engineering, storage and processing of agricultural products. The effective production development requires a comprehensive system of management of agricultural enterprises, which, based on the obtained data, will ensure timely and correct processing.

In digital machines and agricultural technologies, four main areas can be identified: monitoring of environment and parameters of processes; transmission and storage of information; artificial intelligence and cloud technologies; implementation of management decisions by robotic technical means. The main objects of monitoring are soils, plants, animals, weather and climatic conditions, technical means, and technological processes. Ground and air monitoring tools receive and transmit real-time data to the cloud platform. Artificial intelligence optimizes technological operations and gives a command to the actuators using the monitoring data.

Key research themes: agriculture, export, power engineering, digital smart technologies, monitoring means, robotic means, unmanned aerial vehicles.

PROPOSED COLLABORATION

Indian based Research Activity-Development of innovative agricultural extension models,

Dr. R.N.Padaria (Agril. Extension)

Name of Institute- Indian Agricultural Research Institute (IARI), <https://www.iari.res.in>

Collaboration type-Lab to Lab

3 . GENETIC TECHNOLOGIES FOR MEDICINE:

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Genetic technologies play a key role in the development of new approaches to the diagnostics and therapy of diseases. Russian scientists have already successfully developed effective drugs based on monoclonal antibodies are elaborating new products in the field of CAR-T-therapy and recombinant adeno-associated viruses based gene therapy. In addition, implementation of gene diagnostics into practice allows increased efficiency of medical care through a personalized approach to the treatment of diseases. Successful implementation of new technologies and novel diagnostic and treatment methods is impossible without the cooperation of academic science and business. Companies that create favorable conditions for the cooperation with academic science and attracting specialists of various profiles are bringing the mass adoption of genetic technologies, and therefore, enabling victory over many previously incurable, socially significant diseases.

Key research themes: genetic technologies, monoclonal antibodies, prololimab, netakimab, immuno-oncology, gene therapy, CAR, CAR-T-therapy, AAV, gene diagnostics, genome sequencing.

PROPOSED COLLABORATION

Indian based Research Activity- Epigenetics in Health and Disease (EpiHeD) (BSC0118) led by Shantanu Sengupta

Name of Institute- CSIR-Institute of Genomics and Integrative Biology

Collaboration type-Lab to Lab

4. DEVELOPMENT OF THE METHOD OF INTRODUCTION TO CELLS CULTURE AND PLANT REGENERATION OF DECORATIVE FLAX (LINUM GRANDIFLORUM, LINUM PERENNE)

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The features of callus formation, regeneration and rooting in vitro of *Linum grandiflorum* and *Linum perenne*, are investigated. Induction of callus cells were on Gamborg medium with 2,4 D-

dichlorophenoxyacetic acid. Calluses were formed on the surface of the seed. Calluses were light green color. For regeneration, the calluses were transplanted on fresh Gamborg medium with the addition of -naphthylacetic acid and 6-benzylaminopurine. Then regenerants were transplanted on a modified Murashige-Skoog the addition of NAA for further development and rooting.

Key research themes: Linum perenne, Linum grandiflorum, cell culture.

PROPOSED COLLABORATION

Indian based Research Activity- Genome dynamics in Cellular Organization, Differentiation and Enantiostrasis (GENCODE)(BSC0123) led by Souvik Maiti.

Name of Institute- CSIR-Institute of Genomics and Integrative Biology

Collaboration type-Lab to Lab

5. ECOLOGICALLY SAFE PROTECTIVE COATINGS FOR TRANSPORT

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Ways to protect vehicles and transport infrastructure from the effects of negative climate impacts, corrosion, icing, radiation, marine fouling, and biodestruction are considered based on scientific developments of Russian Academy of Sciences' Institute of Silicate Chemistry. New methods and approaches to develop environmentallyfriendly protective coatings are considered.

Key research themes: friendly protective coatings, transport, organic-silicate coatings, sol-gel-derived coatings, paint coatings, corrosion-resistant coatings, radiation resistant coatings, anti-icing coating, antifouling coatings,anti-fungal coatings.

PROPOSED COLLABORATION

Indian based Research Activity- Shri. B. Kalyan Chakravathy, IAS, Director General, EPTRI

Name of Institute- Environment Protection Training and Research Institute (EPTRI)

Collaboration type- Lab to Lab, Lab to Industry

6. AN ASSESSMENT OF THE ANTHROPOGENIC IMPACT ON WATER RESOURCES IN RUSSIA

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Based on the results of research carried out at the Institute of Geography of the Russian Academy of Sciences (Academy of Sciences of the USSR), and using data from other organizations, the impact of various types of economic activity on water resources in Russia and their consequences were estimated. There are indirect anthropogenic effects through relief, soil, biota (rain-fed agriculture measures, forestry, urbanized landscapes) and direct effects (hydraulic engineering, flow transfer, water intake, wastewater discharge). The impact of a complex of anthropogenic factors on the quantity and quality of water resources was assessed. Water use indicators in Russia and other regions of the world were compared. Methods for solving water resource problems have been researched and outlined.

Key research themes: water resources, runoff, wastewater, anthropogenic and climatic factors, change, pollution, consequences, water problems, solutions.

PROPOSED COLLABORATION

Name of Institute- DST-IIT(M)-KGDS, Dr. Sundararajan, IIT-M

Collaboration type-Lab to Lab, RAS to DST

7. DEVELOPMENT OF A TECHNOLOGICAL PLATFORM FOR CREATING INNOVATIVE ANTI-TB DRUGS EFFECTIVE AGAINST MULTI-DRUG-RESISTANT STRAINS.

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This research tackles the issue of the growing morbidity and mortality caused by multi-drug-resistant (extreme drug-resistant) tuberculosis (TB). This issue is aggravated by the alarming rise of immunocompromised patients and immigration worldwide. In order to solve this problem, an interdisciplinary approach is proposed by the Russian side. In order to: (1) develop innovative diagnostic techniques for identifying dangerous lineages of TB with mutations and drug resistance genes; (2) develop antibiotics with new modes of action effective against multiple drug resistance and extreme drug-resistant strains of TB and HIV; (3) develop new genetically engineered vaccines; and, (4) develop new vaccine adjuvants based on probiotic *Lactobacillus* and *Bifidobacterium* strains, with selective immunomodulatory activity.

Key research themes: multiple drug resistance TB, extreme drug-resistant TB, diagnosis, antibiotics, vaccines, vaccine adjuvants.

PROPOSED COLLABORATION

Indian based Research Activity-

1. Hijacking of host lipid droplets by intracellular pathogen *Mycobacterium tuberculosis* (GAP0088) led by Sheetal Gandotra.
2. To understand the function of PE_PGRS family proteins in the survival and virulence of *Mycobacterium tuberculosis* H37Rv (GAP0092) led by Laxman Singh Meena

Name of Institute- CSIR-Institute of Genomics and Integrative Biology,(NIRTHnirth.res.in)

Collaboration type-Lab to Lab

8. ARTIFICIAL INTELLIGENCE AND SOME ISSUES OF RUSSIAN SECURITY PROVISION.

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Some cases of using Artificial Intelligence systems are analyzed in order to give reliable warning and optimal response to man-made and natural emergencies. The researcher considers the set of tasks of information and cyber-security, of increasing the capability to meet natural emergencies.

Key research themes: systems and technologies of artificial intelligence, case study, man-made and natural emergencies. informational and cyber security.

PROPOSED COLLABORATION

Indian based Research Activity- Sudeshna Sarkar Head, Centre for AI Professor,

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Name of Institute-The Centre for Artificial Intelligence,IIT Kharagpur

Collaboration type-Lab to Lab,Industry to industry.

9. EFFECTIVE CHEMICAL METHODS OF FIRE CONTROL: NEW THREATS AND NEW SOLUTIONS

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This research focuses on the prospective flame retardant systems for polymeric materials, while considering the environmental issues they create. Polymer nanocomposites with carbon nano-additives and layered silicates are presented as a new type of flame retardant system which exhibits a synergistic effect flame retardancy for traditional polymer thermoplasts. Particular attention is paid to the novel intumescent flame retardants based on the oxidized renewable raw materials, which can be successfully used in the manufacture of multi-purpose timber construction and polymer materials.

Key research themes: aluminosilicates, flame retardants, montmorillonite, nanocomposites, multilayer graphene, intumescence, heat release rate, renewable raw materials.

PROPOSED COLLABORATION

Indian based Research Activity-The Fire Test and Research Laboratory

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Collaboration type-Lab to Lab

10. MODERN METHODOLOGICAL TECHNIQUES FOR THE PURIFICATION OF CHOLERA TOXIN

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Using various methods, including certain conditions of cultivation of the producer strain, ultrafiltration, and ion-exchange chromatography, a purified preparation of cholera toxin was

obtained through this research work. When controlling its purity in PAGE, it was shown that it lacks protein contaminants and LPS. The model of cell culture CHO-K1 demonstrated a sufficiently high biological activity of purified toxin.

Key research themes: cholera toxin, purification, biological activity.

PROPOSED COLLABORATION

Indian based Research Activity- Emerging and re-emerging challenges in infectious diseases: Systems based drug design for infectious diseases (SPLENIDID)(BSC0104) led by Yogendra Singh

Name of Institute- CSIR-Institute of Genomics and Integrative Biology

Collaboration type-Lab to Lab

11. MODERN APPROACHES TO STORAGE AND EFFECTIVE PROCESSING OF AGRICULTURAL PRODUCTS FOR OBTAINING HIGH-QUALITY FOOD PRODUCTS

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In the modern world, the problem of providing the population with high-quality food products is reaching a critical point due to the increase in the population of the planet, mediated by an influence

on the growth of food consumption; globalization processes, thereby contributing to fundamental changes in the structure and patterns of nutrition i.e., insufficiently effective principles of agricultural raw materials processing, etc.

Today, food independence is a strategic component of a country's security, which is enshrined in a number of regulatory documents, including: the Doctrine of Food Security of the Russian Federation; the Strategy for Scientific and Technological Development of the Russian Federation; the Strategy for Improving the Quality of Food Products in the Russian Federation until 2030; and, others. The stated goals are: updating the priority tasks of group and individual products identification, including on biological and geographical features; unification of evaluation criteria and objective principles for expanding their field; traditional technologies transformation, the potential of which doesn't have the possibility of unlimited replication, etc. It is predicted that the growth of production volumes, processes and consumption systems optimization will be based on the application of a number of basic principles: “lifetime” formation of raw materials composition and properties; development of highly efficient production technologies and deep processing of agricultural products; implementation of algorithms for structuring logistics, storage and processing/disposal of food and waste; increasing energy efficiency of production processes, etc. At the same time, the strategic vectors of technology development are specialized and personalized nutrition, cross-border cooperation, food quality and safety, minimization of negative environmental impact, traceability of the food chain “from field to consumer,” etc. A priori, to achieve all this it will require the introduction of widespread modern technologies, including digital agriculture as well as the modernization of traditional and the creation of new methodological and process decisions.

Key research themes: agricultural raw materials, food products, storage, processing, product losses, personalized food, food systems, food matrices.

PROPOSED COLLABORATION

Indian based Research Activity- Seed quality enhancement by processing, packaging and storage options in low volume seed crops, **Dr.V.K.Pandita** (RS, Karnal)

Name of Institute- Indian Agricultural Research Institute (IARI),<https://www.iari.res.in>

Collaboration type-Lab to Lab

12. RESEARCH OF THE INTERACTION OF ALUMINUM WITH CALLITRICHE PALUSTRIS IN THE CONDITIONS OF FRESHWATER EXPERIMENTAL SYSTEMS

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The changes in the concentration of aluminum (Al) salts in the water of experimental ecosystems (microcosms) were studied in this research work. In the microcosms, aquatic plants *Callitriche palustris* are incubated. Aquatic organism *C. palustris* is used for the first time in biotesting. The purpose of this research is to study the toxicity and dynamics of the concentration of aluminum ions in the aquatic environment of microcosms containing the higher aquatic plant *Callitriche palustris* L. Aluminum concentrations in experimental microcosm water were measured by the fluorescence method. It is convincingly proven that the concentrations of Al ions measured by this method decreased faster than in control systems without plants. On average, two microcosms with shoots removed about 70% of aluminum compared to control microcosms without plants. Macrophyte *C. palustris* has not maintained viability when water is contaminated with aluminum solution. The first signs of phytotoxicity appeared after seven days of incubation (1 week). The total death of macrophytes was arrived at 17 days. There are frequent leaks of aluminum from various industries. The results of the experiments are relevant. New experiments expand information about the role of biota in the self-purification of water and the formation of its quality. The obtained data indicate the possible prospects of using *C. palustris* for phytoremediation.

Key research themes: aluminum, aquatic microcosms, phytoremediation, aquatic macrophytes, *Callitriche palustris*, fluorescence, water pollution, fresh water, water purification.

PROPOSED COLLABORATION

Indian based Research Activity-Centre of Excellence: Waste Utilization & Management (WUM)(ESC0108) led by V. C Kalia

Name of Institute-CSIR-Institute of Genomics and Integrative Biology

Collaboration type-Lab to Lab

13. COULD ONCOLYTIC VIRUSES PROVIDE A BREAKTHROUGH IN ONCOLOGY?

P.M. Chumakov

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Despite the long-term and intensive studies of the nature of cancer and the development of numerous anti-cancer drugs, the incidence of cancer is growing, and the five-year survival of cancer patients diagnosed at the advanced stages of the disease remains unacceptably low. The researchers have examined the causes of the failures in cancer therapy, which are rooted in the very nature of malignant cells, as these cells can adapt and acquire resistance to almost any systemic therapy. In this regard, considerable hopes are associated with oncolytic viruses, which represent a distinct type of remedies capable of complex influences on the disease. In addition to their ability to directly kill cancer cells, oncolytic viruses can stimulate the natural processes of immune surveillance and elimination of cancer cells. Furthermore, oncolytic viruses can kill tumor-initiating cancer stem cells, that are highly resistant to chemo- and radiotherapy, and overcome the immune suppression of the tumor micro-environment. These features make oncolytic viruses unique anti-cancer agents that fight cancer cells by multiple natural mechanisms. To implement virus-mediated cancer therapy into broad medical practice the following are required: intensified studies on viral oncolysis are required and which would include a development of new advanced therapeutic viral strains; development of tests for predicting which virus strains from therapeutic panels are suitable for the patient; and, improvement of technologies for local and systemic delivery of oncolytic viruses to the tumor and metastases. Major changes would be also required in the practices of testing therapeutic drugs that accelerate the introduction of new viral strains into medical practice. Achievements in this direction help to overcome many old problems in the therapy of metastatic forms of malignant diseases.

Key research themes: Oncolytic viruses, cancer therapy, immune therapy, inhibitors of immune checkpoints, cancer progression, therapy resistance, cancer stem cells, tumor relapses, personalized medicine.

PROPOSED COLLABORATION

Indian based Research Activity- Dr. R.S. Dhaliwal, Ph.No: 011-26588381,

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Name of Institute- **INDIAN COUNCIL OF MEDICAL RESEARCH (ICMR)**

Collaboration type-Lab to Lab

14. TERRITORIAL CONNECTIVITY OF RUSSIAN FEDERATION:

FROM STATEMENT OF COMPLEX TASKS TO COMPLEX SCIENTIFIC AND ENGINEERING PROJECTS FORMATION.

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Complex scientific and engineering projects and full innovation cycle programs, ruled to be selected and formed by science and technology priorities' councils, are to become key tools for Strategy in scientific and technological development implementation. In this research work an approach to such programs and projects has been developed by the "Territorial connectivity" S&T priority council, formation. We give the "territorial connectivity" term, separate it by categories and subcategories, characterized by specific social, economic, and administrative and- managerial problems. The researchers propose the set of steps, that is a goal-oriented movement from determination of main program implementation directions to specification of essential complex social and economic objectives within each direction, and then discuss the development of stated problems-solving research plans, scientific and engineering projects, and national policy action frameworks. We use a stage-gate approach in program formation, which allows us to make necessary corrections at every stage of its implementation, as well as organize efficient communication with potential customers and participants.

Keyresearch themes: territorial connectivity, spatial development, complex scientific and engineering programs and projects,intelligent transport systems, forecast & simulation, transport and multifunctional infrastructure, smart city, smart territory.

PROPOSED COLLABORATION

Indian,based,Research-Activity-

DEPARTMENT OF SCIENCE & TECHNOLOGY,

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Name of Institute- Department of Science & Technology

Collaboration type-Institute to DST, Institute to Niti Aayog

15. HIGHLY PRODUCTIVE, ENVIRONMENTALLY PURE LIVESTOCK AND AQUACULTURE WITH GIVEN INDICATORS OF PRODUCT QUALITY.

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The research most important steps toward the development of domestic livestock and aquaculture, involving the production of environmentally-friendly products with desired qualities. Methods for increasing the rate of animal breeding and aquaculture with the latest technologies using modern intellectual systems are considered. The most important steps on the way to a system of normalized nutrition and animal productivity management are discussed. It is shown that the mobilization of the export resource of domestic livestock, the problem of the preservation of biological resources and long-term storage of reproductive material of wild animals. The issues of the relevance of the development of genomic technologies and the biologization of the means of protecting animals, poultry and aquaculture are in reports.

Key research themes: animal husbandry, productivity, selection, feeding, hybridization, biotechnology, genomic technologies.

PROPOSED COLLABORATION

Indian based Research Activity- Institute on Animal Husbandary India/ Indian Veterinary Research Institute.

Name of Institute- Indian Council of Agricultural Research, New Delhi

Collaboration type-Lab to lab

16. RADIOACTIVE CONTAMINATION MITIGATION IN THE ARCTIC REGION.

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This research focuses on the most significant sources of large-scale radioactive contamination to which the Arctic has been exposed since the middle of the last century, which are identified as 1) radioactive fallout and deposition from nuclear weapon testing; 2) plum waste from the Sellafield radiochemical plant (United Kingdom) and Cap de la Ag (France) nuclear fleet operation; 3) radioisotope thermoelectric generators; and 4) submerged and sunken radioactive objects. The research assesses the comparative contribution and associated radio ecological risks of these sources, and special attention is focused on the “nuclear legacy” of the USSR/ Russian nuclear fleet and the search for solutions. The article describes the content and implementation results of the “Development of a Strategic Master Plan for Disposition of Decommissioned Russian Nuclear-Powered Fleet and Rehabilitation of Hazardously Radioactive Sites and Facilities of Its Support Infrastructure” which was developed with broad international cooperation. Attention is drawn to remaining environmental problems associated with submerged and sunken objects that contain spent nuclear fuel and radioactive waste in the Arctic, and the article presents generalized data on such objects and associated risks of water contamination as identified by analyses of model studies of possible accident consequences.

Key research themes: arctic, nuclear submarine, nuclear reactor, core, uncontrolled self-sustaining chain reaction, radioactive substances, human-made radionuclides, nuclear tests, global deposition, contamination, environment.

PROPOSED COLLABORATION

Indian based Research Activity- Shri. B. Bhattacharjee

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Collaboration type-Institute to Institute

17. OPTOGENETICS AND VISION

M.P. Kirpichnikov, M.A. Ostrovsky

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The research focusses on electronic and optogenetic approaches for degenerative (blind) retina prosthesis as the main strategies for the restoration of vision to blind people. Primary attention is devoted to the prospects of developing retinal prostheses for the blind using modern optogenetic methods, and rhodopsins, which are photosensitive retinal-binding proteins, are examined as potential tools for such prostheses. The research also consider the question of which particular cells of the degenerative retina for which rhodopsins can be prosthetic as well as ways of delivering the rhodopsin genes to these cells. In conclusion, the authors elucidate the main provisions and tasks related to optogenetic prosthetics for degenerative retina.

Key research themes: optogenetics, degenerative retina, channel rhodopsins, melanopsin, visual rhodopsin, photoreceptors, retinal bipolar cells, retinal ganglion cells.

Name of Institute- Indian Council of Medical Research (ICMR)/Sankara Nethralaya, Chennai
email-

Collaboration type-Institute to Institute

18. STUDY OF THE EFFECT OF COPD ON THE QUALITY OF LIFE OF PATIENTS ACCORDING TO THE RESULTS OF THE CAT-TEST IN OUTPATIENT PRACTICE.

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The research analyzes the impact of chronic obstructive pulmonary disease (COPD) on the quality of life of patients according to the results of clinical and instrumental examination and ante-testing using the integral CAT-test. The primary treatment of patients with a long history of COPD in stages II and III recorded a greater impact of the respiratory component on the quality of life. Because of complex therapy (inhaled bronchodilators and glucocorticosteroids, antibiotics according to indications, non-pharmacological methods of pulmonary rehabilitation, respiratory gymnastics, and school for patients with COPD) during 1 year of follow-up, there were significant changes in the indicators of quality of life. In patients with the sum of scores on the SAT-test up to 20 showed a decrease in the number and severity of clinical symptoms of respiratory status, and the average value of forced expiratory volume in 1 s (FEV1) remained almost at the same level with a significant improvement in the overall quality of life. In patients with a score of 21 or higher, the FEV1 level after 1 year significantly increased by 12.2%, which is apparently due to a higher level of patient compliance and the effect of pulmonary rehabilitation measures. The results of assessing the impact of different stages of COPD on the quality of life of patients in outpatient practice will improve the monitoring of the course of the disease and optimize the prognosis, state the effectiveness of complex therapy and adjust the dispensary observation plan.

Key research themes: chronic obstructive pulmonary disease, quality of life assessment, respiratory status, dispensary observation.

PROPOSED COLLABORATION

Indian based Research Activity-Therapeutics of chronic obstructive pulmonary disease (COPD) and related respiratory disorders (TREAT)(BSC0116) led by Balaram Ghosh

Name of Institute- CSIR-Institute of Genomics and Integrative Biology

Collaboration type-Lab to Lab, Industry to Industry

SCIENTIFIC ARTICLES AND NEWS

1. YANDEX TO DEPLOY UP TO 1,000 SELF-DRIVING CARS IN THE NEXT TWO YEARS

Currently Yandex has grown its fleet of Driver-less vehicles to 100. Of these vehicles, 35 operate on the streets of Moscow in the presence of a Yandex engineer. The expansion of the fleet is expected to aid the testing of the algorithm changes that the company is constantly making as a part of the development process.

A research published by HSBC Bank earlier this year claimed that Yandex's self-driving technology is at par with its global competitors and was quickly catching up with Waymo, the autonomous driving unit of Alphabet. Although there is no official confirmation, it is estimated that each autonomous vehicle developed by the company costs around RUB6.5 million(\$97,500). Yandex entered the autonomous driving market in 2016 and began testing its first vehicles in 2017. The company currently conducts tests at the Techno-Parks in Russia. It has also received permission to test autonomous vehicles in Israel. Yandex is in constant efforts to make the possibility of carrying out tests in the US a reality, since the regulations on autonomous driving are far more relaxed in the country.

2. PROJECT BARTINI: FROM SCIENCE FICTION TO THE SKIES

www.bartini.aero



“Flying cars were a dream; now they’re a plan,” says Ilya Khanykov, business development director of Project Bartini, a resident startup of the Skolkovo Foundation’s space technologies cluster that is developing a flying taxi. The company’s logo is: “Weird to think of – in 1985. Easy

to hop on – in 2020.” Bartini’s ultimate goal is the mass-scale production of a fully autonomous four-seater car, but it expects to launch a two seater as early as 2018. The vehicle will take off and land vertically, and fly at heights of up to 1,000 metres over distances of up to 200 kilometres.



“The current boom of flying cars has been caused by the simultaneous emergence and maturation of several important trends,” says Ivan Kosenkov.

“First is the emergence and mass use of multicopters with new batteries, allowing improved cargo capabilities and range, and featuring enhanced flight controllers that enable stable flight, even for heavier models, ensuring the mass of 1–4 people can safely be carried. Second is the sharing economy. While owning a flying car will be expensive for ind4.PROJECT BARTINI: FROM

SCIENCE FICTION TO THE SKIES

www.bartini.aero



Users, taking a taxi under an Uber ridesharing scheme would be relatively inexpensive. Third is advanced autopilots, based on navigational infrastructure: enhanced AI algorithms that remove the barrier of piloting skills. In fact, next generation cars are not supposed to be piloted in the way that aircraft and

helicopters were in the 20th century.”



Autopilot or
pointing
directions



Two size classes:
2-seater,
4-seater



Economical and
environmentally
friendly



Solving the
problem of traffic
jams

The German company Lilium completed test flights in 2017 of its electric flying taxi, which takes off vertically like a helicopter, but once in the air accelerates into forward wing-borne flight. Airbus's A3 Silicon Valley innovations outpost is working on a single-seater automated flying car, the Vahana. Both Chinese contender EHang and Germany's Volocopter have signed agreements to test their autonomous aerial vehicles in Dubai. Even within the Skolkovo innovation city, Project Bartini is not alone: a fellow space startup, Hoversurf, is working on a flying motorbike that has attracted international attention, including in Dubai, where the startup signed an MOU with the Dubai police, who are reportedly interested in the flying motorbike's potential use for responding to emergency situations



At least eight companies have conducted flight tests in the past four years and several more had scheduled tests before the end of 2018, according to a report by the Frost and Sullivan research and consulting organisation titled "Future of Flying Cars 2017– 2035." That report identified other uses for flying cars, including as air ambulances and for law and order, military and surveillance purposes. Project Bartini uses blockchain technology in virtually every aspect of its work. The technology is predicted to revolutionise the aviation industry over the next few years with its system for

keeping records in linked data blocks. At the 2017 Paris Airshow, John Schmidt, director of aerospace and defense at the innovations consultancy Accenture, said blockchain was the next great innovation in aeroplane maintenance due to its detailed data of factors such as engine usage. "Blockchain is in effect a single federated ledger that everybody who uses and touches that engine could use it as a single point of truth of what has happened to the engine," said Schmidt. "Blockchain is fantastic," says Khanykov. "From manufacturing to maintenance to resource measurements to passenger recognition, blockchain can be used to streamline processes." Project Bartini is part of the Blockchain Aero consortium, a business platform for all participants of the

mass urban aviation market. Skolkovo's space cluster is, however, keeping a close eye on such projects and is eager to help them get their idea to the market, says Kosenkov. "We believe that these companies certainly have great potential," he added. In terms of legislation, Russia is no different to other countries, says Kosenkov. It's crucial to keep up with changing possibilities in order not to be left behind, but in this respect, AeroNet – the section of the government's National Technology Initiative devoted to stimulating the market for unmanned aerial vehicles – is doing a great job, he said.

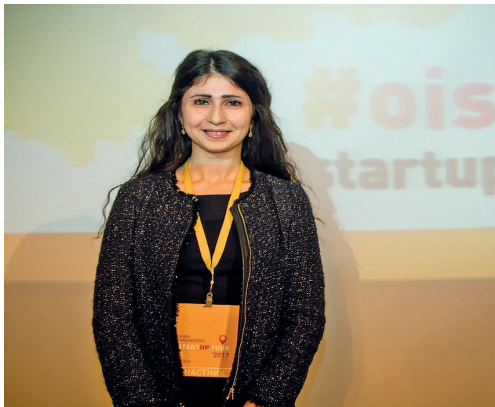


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next great innovation in aeroplane maintenance due to its detailed data of factors such as engine usage.

3. ENDOMETRICS: DIAGNOSING ENDOMETRIOSIS

www.endometrics.ru



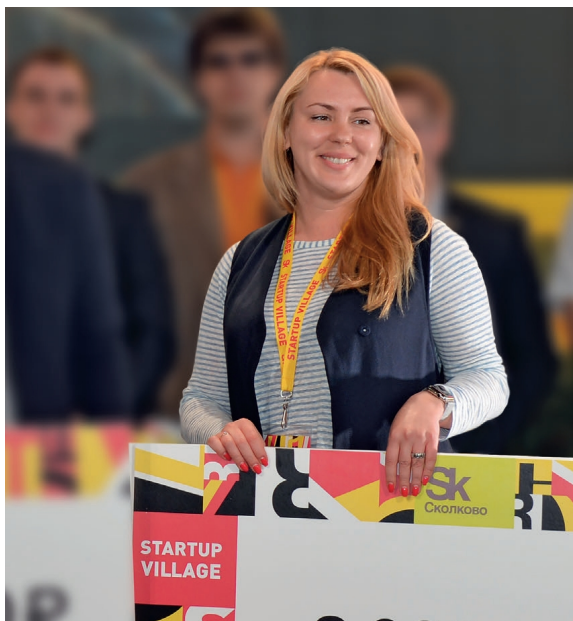
Goldberg's got it. Susan Sarandon has it. So has Dolly Parton, and they're far from alone. An estimated 176 million women around the planet suffer from endometriosis, a condition in which tissue that normally grows inside the uterus (endometrium) grows outside of it, often causing great pain and leaving up to half of its sufferers infertile. One of the problems associated with endometriosis is difficulty and

delays in diagnosing it. Now Russian biomed startup Endometrics is developing a minimally invasive testing system that could save millions of women years of frustration and false diagnoses. Endometriosis can be a devastating condition. Nearly half of the women who suffer from it endure chronic pelvic pain, and endometriosis is notoriously difficult to diagnose. It is not known what causes the condition, and there is no cure, but symptoms can be alleviated with surgery or hormone treatment. Despite ongoing efforts to identify biomarkers that would enable non-invasive diagnosis,

currently, the only surefire diagnosis method is a laparoscopy – a surgical procedure in which a camera is inserted through an incision in the belly to look at the abdominal or female pelvic organs. The Moscow-based Endometrics project, a resident startup of the Skolkovo Foundation’s biomed cluster, aims to develop a test for the early and minimally invasive diagnosis of endometriosis based on intracellular processes. “Endometriosis is a multifactorial illness, at the basis of which lie an array of molecular abnormalities,” says Yana Garazha, head of Endometrics. “For this reason, our research is based on a comprehensive approach: we’re not looking for a particular mutation or a specific protein biomarker, we’re assessing the whole pool of intracellular abnormalities that occur in cells in endometriosis patients.” In 2015, the group analysed 14 samples of the eutopic (inside the womb) and ectopic (outside the womb) endometrium from six patients, and found a strong correlation between the activation of intracellular signalling pathways in the cells of both kinds of endometrium. The results of that analysis were then presented at the 17th World Congress of Gynecological Endocrinology in March 2016 in Italy, and at the 45th AAGL (American Association of Gynecologic Laparoscopists) Global Congress in Florida in November 2016. The following month, Endometrics became a resident of the Skolkovo Foundation, and in January 2017, its application for a microgrant to carry out the next series of analysis was approved. A startup has won 1 million rubles (\$17,000) in Russia. “The move over to non-invasive screening is a worldwide trend, so we are optimistic about the project’s prospects,” says Vladimir Egorov, Endometrics’ project manager within Skolkovo’s biomed cluster. Although in recent years, endometriosis has been the focus of more attention in the West (the condition now has its own designated global awareness month: March), Endometrics believes its precise research focus is unique. “Professor Linda Guidice at the University of California, San Francisco is studying the transcription of cells, but only in eutopic endometrium, while we are studying both eutopic and ectopic endometrium, and are determining the correlation of abnormalities in the endometrial tissues in different locations,” says Garazha. Scientists at the Medical University of Vienna are also studying biomarkers as a potential way of diagnosing endometriosis. “Treatment of patients is decided on an individual basis and depends on factors such as the severity of the symptoms, the patient’s age, the type of endometriosis, the patient’s desire to become pregnant, and the existence of concurrent conditions. But the main treatment methods are the same in Russia as in most other countries: hormone therapy and surgery to remove endometriosis and cysts,” says Garazha.

4. DEVELOPING A CURE FOR HIV: AGCT

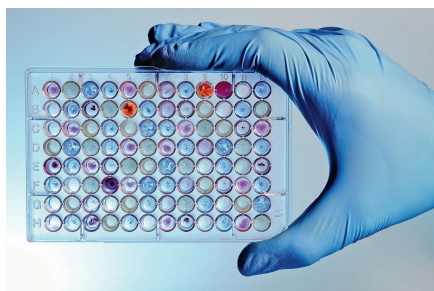
www.agct.bio



The St. Petersburg-based company is developing a method to treat HIV by editing a person's DNA. The aim is to treat patients with lymphomas (blood cell tumours) and HIV, for whom a bone marrow transplant is justified. The technology is based on altering the CCR5 coreceptor gene, which is responsible for the HIV virus's entry to cells, inside the patient's bone marrow cells. After the cells are extracted from the bone marrow and edited *ex vivo* to remove the CCR5 coreceptor, they are then transplanted back into the patient, where they enter the immune system and become impervious to the most

common HIV subtypes. Advanced Gene & Cell Technologies (AGCT), is carrying out Russia's first clinical practice of genome editing to treat HIV.

There are two project based on CCR5 knockout for HIV treatment: AGCT-001 Hematopoietic stem cells (HSCs) are among the most promising targets for the gene manipulation since they comprise a pluripotent progenitor population of stem cells giving rise to a variety of blood cells, gaining a lifetime- long generation of immune cells resistant to HIV.

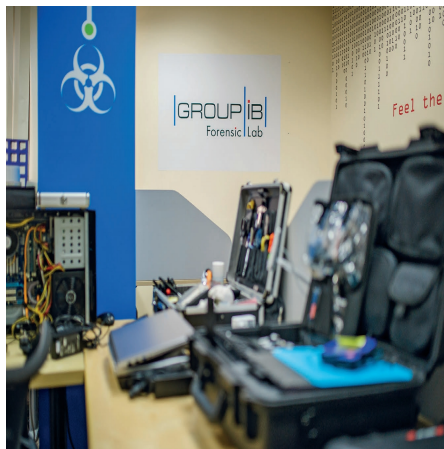


AGCT-Z In this product, the TALEN platform is used for CCR5 knockout in patients T-lymphocytes. While T-lymphocytes are the main target for HIV infection, important features of these cells are long circulation period and ability for proliferation upon activation. Because of this, even the small CCR5 deficient cell

population gains selective advantage over ordinary T-cells. This phenomenon helps to achieve immune control over disease and open the way for functional cure. "The use of genome editing in HIV treatment was discovered by chance, because there are some people who have a natural immunity to HIV via a gene mutation: that is to say, nature already invented a cure for HIV," Marina Popova, AGCT's CEO and founder, told a panel discussion held as part of Skolkovo's annual Startup Village event in 2016.

5. GROUP-IB: PATROLLING THE CYBER UNDERWORLD

www.group-ib.ru



Group-IB, a startup in Russia investigates about 80 percent of high-profile cybercrimes in Russia and the CIS. As well as investigating crimes that have already been committed, Group-IB's Threat Intelligence system uses AI to detect threats. The system analyses a company's weak spots and predicts what form an attack might take. Since 2003, the company has been active in the field of computer forensics and information security, protecting the largest international companies against financial

loss and reputation risks.

The Russian company has helped to bring numerous international hacking gangs to justice, frequently working in cooperation with Interpol and Europol. In spring 2017, Group-IB helped Russia's Interior Ministry catch a gang of hackers suspected of using a Trojan virus to steal money from more than one million bank accounts via mobile banking apps. And in December of the same year, it revealed that another criminal group dubbed MoneyTaker had carried out at least 20 successful attacks in Russia, the U.S. and U.K., stealing up to \$10 million – and had largely gone unnoticed. The Russian cybersecurity experts used their Threat Intelligence system to discover connections between all 20 incidents, which took place between May 2016 and November 2017. “Group-IB has provided Europol and Interpol with detailed information about the MoneyTaker group for further investigative activities as part of our cooperation in fighting cybercrime,” the company said. The company has been studying various hacker groups and scammers and their constantly evolving tools and schemes for years. “They are driven by financial motivation, and, since the inception of the blockchain industry, many of them have shifted their focus to this new market: hackers’ methods of work in relation to fintech projects are similar to those used for attacks on online banking and electronic payments systems. However, unlike the banking segment, fintech is not subject to the regulator’s requirements, the level of information security depends only on each project itself,” Sachkov said in a statement this year announcing that Group-IB had teamed up with the Waves open-source blockchain platform to shut down a phishing scam targeting its users. Sachkov said Waves was setting an example for the crypto industry by taking earlier action.

“Protection of the business and its assets is a priority for any industry, regardless of its age,” says Sachkov.

EVOLVING THREATS

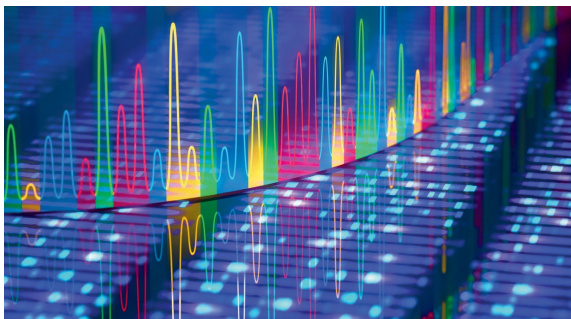
Group-IB predicted last year that cryptocurrency exchanges would be the most likely hacking targets in the near future, along with banks and power stations. “The number of threats for cryptocurrency and blockchain projects recorded by our Threat Intelligence system has rocketed alongside the bitcoin rate,” Dmitry Volkov, head of the Threat Intelligence department and co-founder of Group-IB, said back in October, presenting the company’s Hi-Tech Crime Trends 2017 report at a conference. Group-IB predicts more attacks on the crypto-currency industry carried out not only by financially motivated thieves, but by state-sponsored attackers too. “In technical terms, the attacks against service providers in this sector are no more difficult than against banks, however the information security in place and maturity of blockchain companies is significantly lower. A further motivation for criminal attackers is that blockchain technologies are more anonymous and unregulated: this considerably reduces the risk of being caught during money withdrawal,” the company said. The total damage caused by targeted hacker attacks on the crypto-currency industry amounts to more than \$168 million, according to Group-IB.



Sachkov

6. TELEMEDICINE IN ACTION: UNIM LAB OFFERS CANCER PATIENTS CRUCIAL SECOND OPINION

www.unim.su



UNIM lab startup offer cancer patients around the country the chance to get expert opinions on their tumours by digitalizing slides and sending them to the world's top specialists. Sometimes, a second opinion can save a life

MACHINE MAGIC

At this point, in the words of Karpova, “the new technology magic begins.” The slide is put into an immunohistochemistry machine that performs selective imaging of the antigens (proteins) in the cells by recording their reaction to various antibodies. This enables the doctors who analyse the slide and other clinical information such as CT and MRI scans to say with great accuracy what kind of cancer it is, and how aggressive it is, says Karpova. “If we know it’s breast cancer – one of the most common cancers in the world right now – then we test the cells’ reaction to certain antibodies such as progesterone,” says Karpova. “We look at how the cells react and how many of them do so, and determine what stage the cancer is at and how aggressive it is. Then the doctor writes the diagnosis and prescribes the treatment.” Because immunohistochemistry machines and testing are very expensive, regular state clinics in Russia do not often have such equipment and cannot run those tests, Karpova said. But what the UNIM lab does next is rarer still: it is done in just two other labs in the world, in the U.S. and the Netherlands, she said. “Usually at this stage, the doctor looks at the slide through the microscope, and that’s it. We scan everything to create a digital slide, which is sent to the cloud,” explains Karpova. This digital slide can then be sent to the leading experts in that kind of cancer, wherever in the world they happen to be. The digital scan acts like a microscope, enabling doctors to enlarge areas of interest. In one part of the UNIM lab, doctors pore over scans of histological slides on their computer screens as they write their conclusions. “We use our Digital Pathology system, which enables a large number of doctors to examine the slide in a short period of time,” says Karpova. BRAND UNIM was founded in 2013, and became a resident company of the Skolkovo Foundation back in 2015 after winning the diagnosis systems category of the OncoBioMed competition jointly organised by the foundation and the Federal Agency of

Scientific Organisations. The company previously worked from other mlabs, but soon realised they needed their own dedicated space. “Our aim was to show how a digital lab could work and to develop this field, and we built our own lab using investment,” says Karpova . If we worked from a hospital, it would be completely different,” she said, adding that the Skolkovo brand had been a big help in promoting UNIM’s development in Russia’s regions. The lab employs about a dozen people, and is fully immersed in the Skolkovo ecosystem: it has the status of a shared resource centre, meaning it can perform paid services for other Skolkovo startups that need to use its equipment, and works closely with the Sk Bio- Lab, a shared lab for biomed startups at the Technopark. UNIM is also hoping to cooperate with the Moscow International Medical Cluster at Skolkovo, whose first facility opened in September 2018, particularly if the cluster does not have its own pathomorphology lab. Skolkovo also provided consulting support via its investment service in 2017 when UNIM raised an undisclosed sum of investment from Medme, a strategic investor on the digital medicine market.

EDITED BY: Counsellor (S&T), and Staff of S&T Wing