3d bioprinting solutions
creating future possibilities

3D Bioprinting Solutions
Company Overview

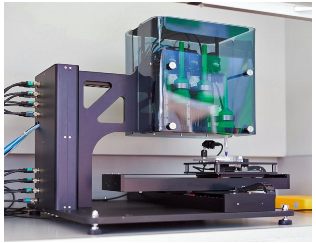
COMPANY MILESTONES

3D Bioprinting Solutions focus on 3D bioprinting and work on the whole range of the hardware, materials, technologies, and products comprising the 3D bioprinting industry.

2013

Our biotech laboratory with multinational scientific team is founded in Moscow

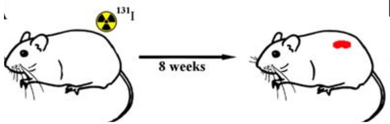
2014



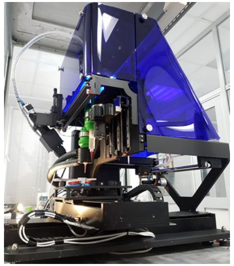
Presentation of proprietary FABION bioprinter

2015

Bioprinting and successful transplantation of living functional mouse’s thyroid gland construct



2016



Presentation of brand new FABION 2 bioprinter

2017

New magnetic bioprinter developed

2018

Experiments on biofabrication in space on board the ISS with brand new Organ.Aut magnetic bioprinter

Product Pipeline

Our product pipeline – from the earliest stages of R&D to commercial manufacturing - includes 3D bioprinters based on different technologies (consistently rated among the top bioprinters in the world) and various tissue and organ constructs.

We had printed a murine thyroid gland construct and successfully implanted it into laboratory animals. The company continues working with human cells creating 3D bioprinted tissues and organoid models for drug discovery and disease modeling as a superior alternative to traditional 2D models.

In December 2018, our proprietary 3D bioprinter, Organ.Aut, was launched into space on board the International Space Station to perform formative biofabrication of 3D tissue and organ constructs in microgravity, opening for us, among other things, the opportunity to further expand our business to science (B2S) services.

Partnership

The company strongly benefits from its close partnership with a worldwide network of leading biotechnical, medical and engineering research centers and academic institutions, pharmaceutical companies, hospitals, and software companies, including the largest independent medical lab network in Eastern Europe, Invitro, founded by Alexander Ostrovskiy.

This allows us to combine access to the enormous scientific talent pool and first-rate facilities and resources of these organizations with radical cost-efficiency.

3D Bioprinting Solutions’ Chief Scientific Officer, Professor Vladimir Mironov is considered one of the founding fathers of bioprinting.

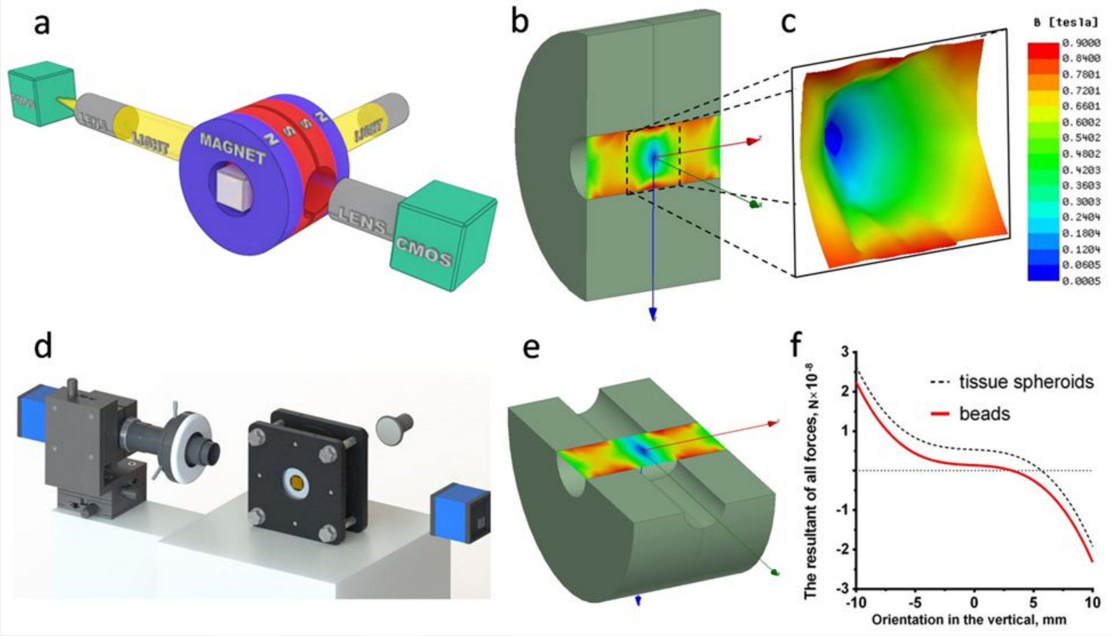
Synergetic Value

We strongly believe that at this stage of the industry development, the synergetic value of integrating the biological and the engineering sides of our business exceeds the potential advantages of specialization.

Naturally, as the industry itself matures and some of our specific lines of business reach certain point of growth, we envision considering the possibility of spinning them off to evolve into a self-sufficient business venture or to commercialize its product through a partnership with an established market player.

IP Portfolio

The company’s extensive and rapidly growing IP portfolio adds value to our business and provides the necessary legal protection for our devices and methods (as well as trademarks) in the United States, Eurasia and globally.



ЕВРАЗИЙСКАЯ ПАТЕНТНАЯ ОРГАНИЗАЦИЯ
ЕВРАЗИЙСКОЕ ПАТЕНТНОЕ ВЕДОМСТВО

ЕВРАЗИЙСКИЙ ПАТЕНТ

ЕВРАЗИЙСКИЙ ПАТЕНТ

№ 028039

Название изобретения:

«УСТРОЙСТВО И СПОСОБЫ ПЕЧАТИ БИОЛОГИЧЕСКИХ ТКАНЕЙ И ОРГАНОВ»

Патентовладелец (льцы):

ЧАСТНОЕ УЧРЕЖДЕНИЕ ЛАБОРАТОРИЯ БИОТЕХНОЛОГИЧЕСКИХ ИССЛЕДОВАНИЙ "3Д БИОПРИНТИНГ СОЛЮШЕНС" (RU)

Изобретатель (и):

Миронов Владимир Александрович, Хесуани Юсеф Джоржевич, Митрошин Александр Николаевич, Гладкая Ирина Сергеевна, Островский Александр Юрьевич, Новоселов Сергей Владимирович (RU)

Заявка №: 201401046

Дата подачи заявки: 05 сентября 2014 г.

Дата выдачи патента: 29 сентября 2017 г.

Настоящим удостоверяется, что евразийский патент выдан на изобретение с формулой, опубликованной в Бюллетене Евразийского патентного ведомства «Изобретения (евразийские заявки и патенты)» № 9 / 2017 год.

При уплате установленных годовых пошлин патент действует на территории государств - участников Евразийской патентной конвенции – Азербайджанской Республики, Кыргызской Республики, Республики Армения, Республики Беларусь, Республики Казахстан, Республики Таджикистан, Российской Федерации, Туркменистана.

ТЛЕВЛЕСОВА Сауле Январбековна
Президент Евразийского патентного ведомства

3D Bioprinting and Its Applications

3D bioprinting is an automated and computerized process of layer-by-layer printing of 3D tissues, organ constructs or whole organs by using cells or tissue spheroids (cell aggregates) as bioink and using biodegradable hydrogels, holding cells or spheroids in place and providing a nutritional environment.

Naturally, 3D bioprinting requires special printers (3D bioprinters) that dispense bioink and biopaper with high precision according to the instructions received from a computer aided design (CAD) file. Subsequently, the printed tissue/organ construct may be placed in a bioreactor, a mechanical unit creating a biological environment necessary for tissue/organ construct's growth and development.

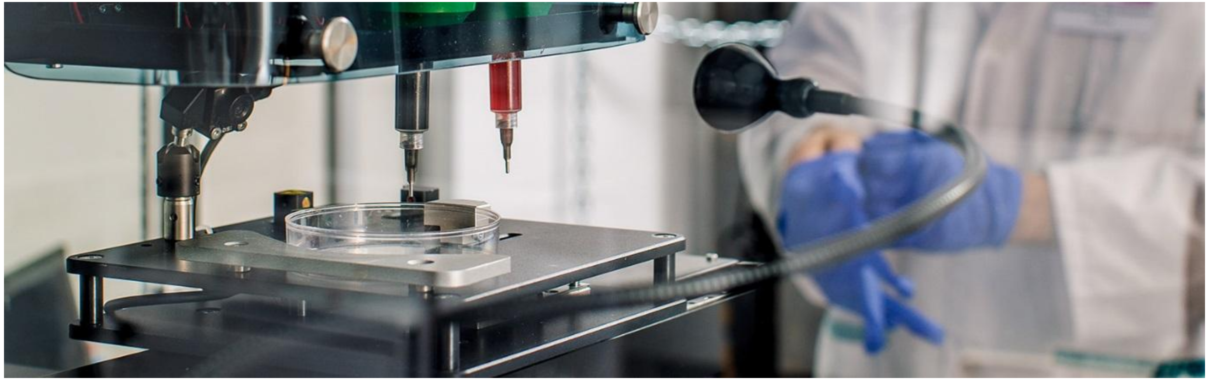
Organ Printing

3D bioprinting represents the best economical and viable opportunity to close the gap between the limited number of donated organs available for transplantation at any given time and the long waiting list of potential recipients, whose very survival depends on timely receiving a needed match.

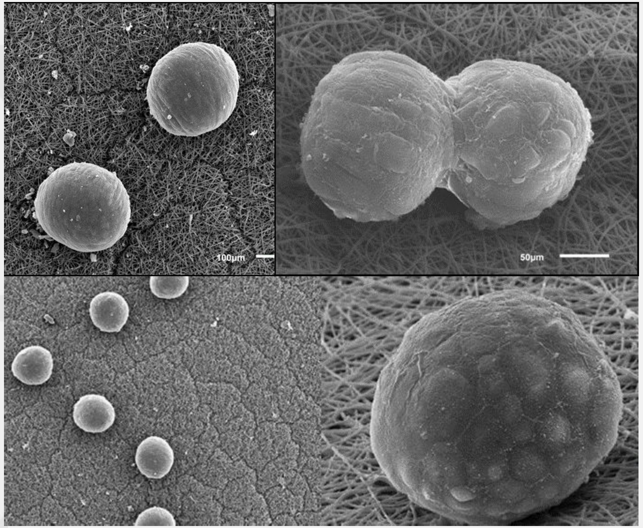
Moreover, made out of the patient's own cells, such a transplant will potentially eliminate the danger of organ rejection without any need for immunosuppressant drugs. Saving millions of lives, this fast, precise, and efficient way of manufacturing transpalnts on demand will be one of the most important scientific breakthroughs in human history.

Drug Discovery and Disease Modeling

3D printed organ constructs offer a much more efficient way to test prospective drugs, allowing drug manufacturers to save time and billions of dollars in costs and time delays wasted on dead-end drugs that eventually fail in clinical trials.
In terms of personalized healthcare, printed organ constructs using patient’s own cells allow testing the effects of a complex combination of various drugs on that specific patient.
3D bioprinting significantly advances disease modeling in search of potential treatment and will allow a personalized treatment approach tailored precisely for an individual patient.
For the cosmetic industry, testing its products on 3D printed organ constructs is not only more efficient but may represent the only way to conduct tests, as animal testing of cosmetic products is already banned in many countries.

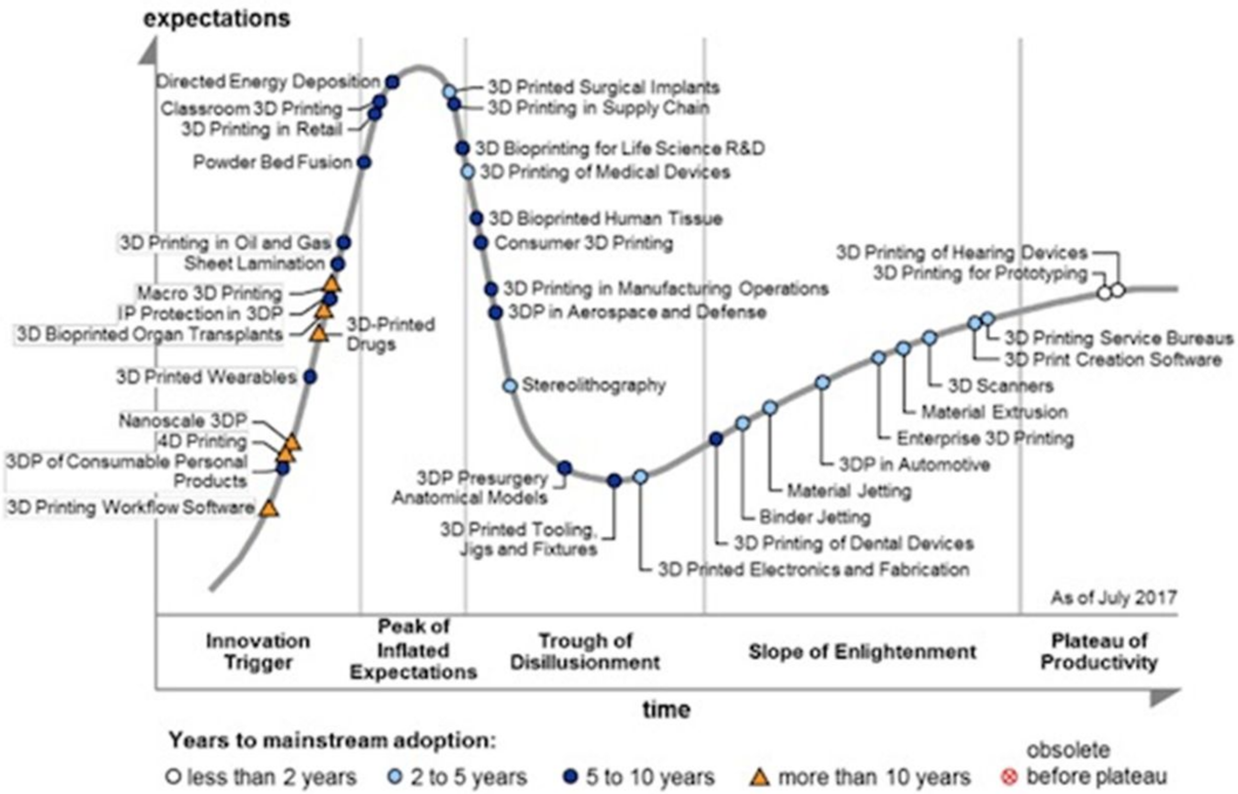


Tissue Spheroids As Bioink



1.Serve as building blocks
2.Allow the fabrication of functional tissue and organ constructs.
3.Fuse or self-assemble by the force of surface tension.
4.Have a very high cells density
5.Produce extracellular matrix
6. Have capability to be spread on an adhesive surface
7. Printing with spheroids significantly increases the speed of the process of 3D bioprinting.

Market Overview



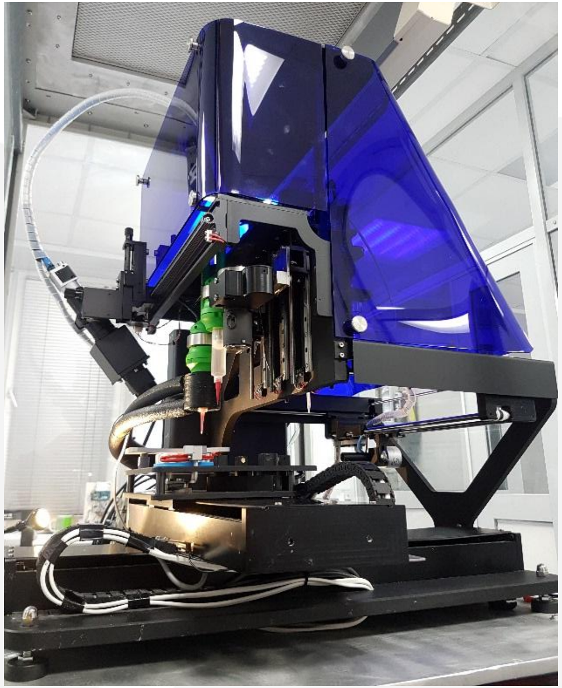
Multibillion-dollar industry within the next 10-15 years.

Most reports expect it to reach $1-1.8 billion within the next five years and up to $10-12 billion by 2030.

18% - 36% CAGR forecasts

Markets: academia/research centers, pharmaceutical, cosmetic, and chemical companies, the military and hospitals.

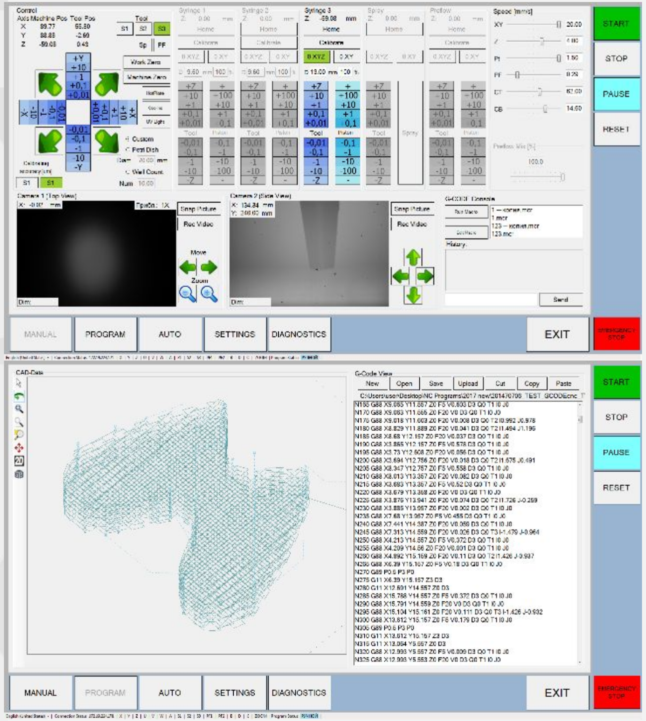
The FABION Line Of Bioprinters



Truly universal tool for printing live and functional 3D tissue and organ constructs superior to other commercially available bioprinters due to its

- **multifunctionality** (allows printing with a wide range of bioinks and hydrogels and using different types of polymerization),
- **safety** (a unique UV tool for hydrogel polymerization does not contact with spheroids or cells and, consequently, does not damage their DNA),
- **flexibility** (allows combining different methods of bioprinting, methods of application, materials, and bioprinting parameters),
- **precision** (its resolution meets the highest standards in bioprinting and the laser calibration system has a feedback feature for accurate nozzle positioning),
- **control** (printing is controlled in the real time mode with the help of an in-built digital camera).

FABION 2



- Allows using different number of nozzles and in different configurations, is compatible with various 3D modelling programs, and supports different polygonal modelling file formats.
- FABION 2, introduced in 2017, represents a significantly upgraded version of our landmark FABION bioprinter.
- It is equipped with higher resolution cameras recording in real time the printing of a construct from different perspectives and also features a 2-in-1 nozzle installed together with a mixer, which improves the mixing of gel components providing a more qualitative polymerization.

Magnetic Bioprinters

The company works on new types of bioprinters, based on magnetic levitation in a controlled magnetic field. This revolutionary biofabrication methods would transform the technology of 3D bioprinting, while opening real opportunities for programmable self-assembly of tissue and organ constructs without solid scaffolds.

In 2017, we developed the Organ.Aut magnetic bioprinter and magnetic bioprinting technology and signed an agreement with Roscosmos (the Russian Space Agency) to send our magnetic bioprinter to the International Space Station. On December 3, 2018, the Organ.Aut bioprinter was delivered to the ISS on board the Soyuz MS-11 manned spacecraft. For the first time on orbit, cosmonaut-researcher Oleg Kononenko printed human cartilage tissue and a rodent thyroid gland using a bioprinter.

Vivax Bio now owns a permanent part of scientific equipment on the ISS, this in turn enables us to provide the magnetic bioprinter as infrastructure for a wide range of biotechnology experiments.

Organ Constructs

We are working on a platform technology that our company is using to create endocrine micro-organs (organ constructs) with our proprietary tissue spheroid bioprinting.

As the first step in this direction, in March 2015, we printed the first mouse thyroid gland construct and successfully implanted it into laboratory animals.

The construct works as a substitute for a lost or defective gland, containing more than enough of thyroid gland's functional follicular cells. The choice of thyroid gland as the first organ to be printed was not accidental.

We expect this technology to allow us restoring the functions of such endocrine organs as the thyroid and parathyroid glands, pancreas, adrenal glands, and ovaries, while making automating and standardizing this process.

3D Bioprinted Organoid Models For Drug Testing

3D bioprinted models are a highly reliable and versatile instrument for selection and validation of promising drug candidates providing:

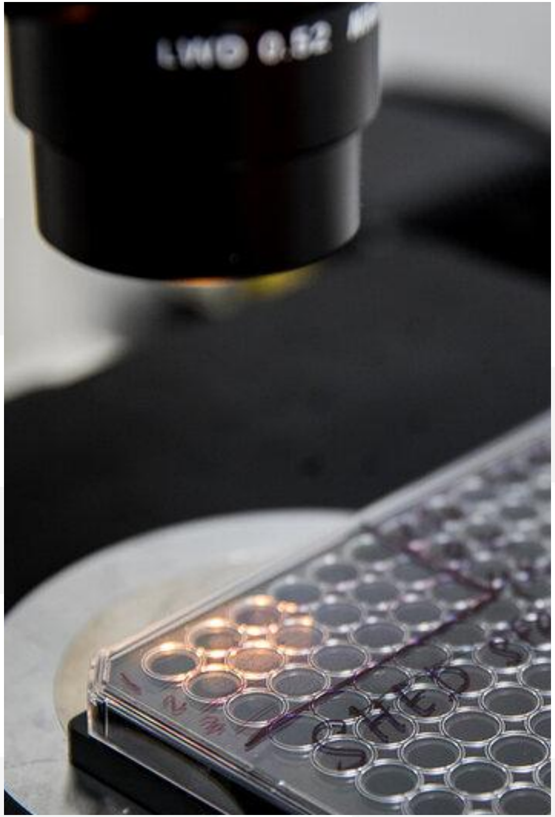
- ADME (absorption, distribution, metabolism and excretion);
- Efficiency at different drug concentrations and time points;
- Identification of the most effective partners for combination therapy;
- Identification of the most responsive tumor types;
- Individualized cancer therapy when spheroids are prepared from patient tumors.

Bioprinted organoids closely mimic the biology of microtissues: biomarker expression, natural physiological characteristics and therapeutic resistance.

Specific cell lines are suitable for pathology modeling in 3D. Importantly, 3D organoids exhibit high cell-to-cell interaction and tissue architecture similar to *in vivo*.

Offering a more complex structure, 3D organoids are invaluable for repositioning existing drugs for novel therapeutic indications.

Clean Meat



In 2018 we started to adapt our existing technologies for cellular agriculture applications. Framework agreements have been signed with several leading startups in the field of clean meat and now we are to carry out several joint experiments using muscle cells of various species.

Moreover, as a company, which has already gained a lot of experience and expertise with both bioprinting and space-related engineering designs, we believe that biofabrication of cultured meat in space has several unique advantages:

- Sustainability
- Optimization
- Biosafety
- Psychological support
- Ethicality

Our Team

YUSEF KHESUANI, Managing Partner

After he had started and successfully developed a number of medical and life science businesses, Yusef co-founded 3D Bioprinting Solutions where he serves as Executive Director and Chief Operating Officer. Yusef is an expert in the fields of genetic research and regenerative medicine and had previously worked at Herzen Moscow Oncology Research Institute, Department of Nonsurgical Treatment Efficiency Appraisal. He is the author/co-author of a number of scientific publications on 3D bioprinting and related subjects. Yusef graduated from the School of Fundamental Medicine at Moscow State University (MGU) and received an MBA from the Higher School of Management at the National Research University Higher School of Economics

Our Team

ALEXANDER OSTROVSKIY
Executive Chairman

Alexander is a veteran of the life science and diagnostics industry. In the early 90-s, in Moscow, Russia, he started OMB, a medical supplies company, and soon after that – INVITRO, which rapidly expanded both domestically and internationally and is now the biggest independent medical lab company in Eastern Europe. Alexander currently serves as CEO of INVITRO and the Chairman of the Board of the INVITRO Group. In 2013, Alexander co-founded 3D Bioprinting Solutions and is the Chairman of its Supervisory Board. An anesthesiologist and intensive care specialist by training, Alexander received his M.D. from N.A. Semashko Moscow Medical Institute and holds a Ph.D. in medical science. He earned an MBA from the Higher School of Management at the National Research University Higher School of Economics.

VLADIMIR MIRONOV
Chief Scientific Officer

Vladimir is considered a pioneer in bioprinting and has been the CSO at 3D Bioprinting Solutions since 2013. An expert in managing multidisciplinary studies, he conducted research and taught in leading universities and research centers in the United States, Germany, Brazil, Singapore, and Russia. His accomplishments have been recognized by numerous awards. Vladimir created and headed the Advanced Tissue Biofabrication Center at the Medical University of South Carolina. He is currently working at the Center for Information Technology Renato Archer, Campinas, State of São Paulo, Brazil, and is an adjunct professor at the Moscow Institute of Physics and Technology, Russia. Vladimir is the author of numerous articles in leading scientific publications and is named as an inventor in a number of patents. He graduated from the School of General Medicine at Ivanovo State Medical University and holds a Ph.D. in Histology and Embryology

Our Team

VLADISLAV PARFENOV

Chief Designer

ELENA BULANOVA

Head of Cell Technologies Laboratory

In 2012, Vladislav Parfenov graduated from the Moscow Power Engineering Institute’s Department of Power Plant Engineering.
In 2015, he completed a postgraduate course in materials science at the Moscow Power Engineering Institute.
While working on his thesis: “Improving the quality of continuous casting and sleeve by processing the cast structure and selecting optimal settings for the mill using the criteria of share transverse strain,” he developed an improved piercing mode for the Seversk Pipe Plant.
From 2011-2015, Vladislav Parfenov worked in the High-throughput Materials Processing Group at the P.I. Baranov Central Institute of Aviation Motors.
Parfenov has coauthored a number of patents and research papers.

Prior to joining our team, Elena worked as a research fellow at the Department of Cell and Molecular Biology of Northwestern University, Chicago, Illinois, at the Carcinogenesis Mechanisms Research Laboratory of N.N. Blokhin Russian Cancer Research Center, Moscow, Russia, and at ChemRar High-Tech Center, Khimki, Moscow Region, Russia, where she headed the screening and cell test systems lab performing clinical and pre-clinical studies for major pharmacological companies. She is a leading expert in cell spheroids formation and biofabrication. Elena earned her B.S. in biochemistry from the School of Biology at Moscow State University (MGU) and received a Ph.D. in Biology from Blokhin Cancer Research Center.

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THANK YOU !