





**Federal State Budget Institution** 

## "National Medical Research Center of Obstetrics,

**Gynecology and Perinatology named after Academician** 

V.I. Kulakov" of the Ministry of Health of Russia

Moscow

Federal State Budget Institution "National Medical Research Center of Obstetrics, Gynecology and Perinatology named after Academician V.I. Kulakov" of the Ministry of Health of Russia Moscow



Main building



**Perinatal Center** 



Gennady Sukhikh Director Academician of Russian Academy of Sciences

- 2, 800 employees 10 000 births 23 000 surgical procedures 22 operating rooms 18 labor wards 600 beds
- 24 laboratories
- 25 clinical departments
- 180 000 consultations
- per year
- > 1 000 000 tests

- Institute of Obstetrics
- Institute of Neonatology and Pediatrics
- Institute of Oncogynecology and Mammology
- Institute of Anesthesiology and Resuscitation
- Institute of Reproductive Genetics
- Institute of Reproductive Medicine
- Institute of Epidemiology and Microbiology
- Institute of Translational Medicine (coming soon)

- Simulation and Training Center
- F. Paulsen Sr. ART Academic Center
- Telemedicine Center
- R&D Department
- Regional Integration Department
- Department of International Cooperation
- RSOG Headquarters
- National Journal *Obstetrics and Gynecology* Editorial Board



#### FUNCTIONS OF THE NATIONAL CENTER





### LABORATORY UNIT: 24 laboratories and **Biobank**

- Diagnostic
- Clinical immunology
- Molecular genetics
- Reproductive genetics
- Microbiology
- Clinical pharmacology
- Clinical epidemiolody
- Pathology
- Mitohondrial medicine
- Neurocybernetics
- Molecular adaptation

- Cell technologies
- Regenerative medicine
- Cytology
- System biology in reproduction
- Proteomics and metabolomics
- Cells pathophysiology (micro RNAs)
- Bioinformatics
- Genome editing
- Genetic mechanisms of development
- Biobank







#### Storage space 20 refrigerators with 590, 000 storage units overall



Storage conditions and monitoring comply with international standards (ISBER, BBMRI-ERIC). The laboratory is equipped with EBRO system – temperature and humidity monitoring in refrigeration systems and rooms.

#### **Samples**

- Almost 600,000 samples from 50,000 patients with various obstetrical, gynecological and neonatal pathologies, including cervical cancer, ovarian cancer, breast cancer, preeclampsia, gestational diabetes, habitual miscarriage, fetal growth retardation syndrome, chromosomal aberrations.
  Material: placenta, umbilical cord, amniotic fluid, fetal and embryonic tissues, biologic liquids, pathologic tissue samples, etc.
- All samples are characterized in detail with patients' demographic and clinical features, anonymized and bear a QR –code
- Biobank is integrated into the Center's internal patients database Medialogue and therefore easily accessible for clinicians and researchers

#### 256 specific sample collections

The Center's unique biobank collections	
Collection title	Number of samples
Rare tumors	159
Single-gene disorder	5,995
Endometriosis in adolescents	1,100
Congenital anomalies	722
Newborns from women with placenta accrete	450
Ovarian cancer	2,904
Cancer in pregnant women	553
Non-immune hydrops fetalis	629
Feto-fetal transfusion syndrome	923
Breast cancer	8,924
Male infertility	490
The impact of chemotherapy on pregnant women with cancer	246
PCOS	9,734
Uterine myoma	2,887
COVID-19 in adults	26,011
COVID-19 in children	1,054





### **Institute of Reproductive Genetics**

- Non-invasive prenatal DNA screening of fetal aneuploidies based on maternal blood
- Molecular karyotyping (micro-matrix DNA analysis)
- Preimplantation genetic screening (PGS)
- Study of > 60 000 single nucleotide polymorphism in the genome and > 55 000 MRNA measured levels
- Sequencing of > 100 bacterial genomes
- BRCA genes mutations tests
- > Implementation of preimplantation genetic testing using aCGH and NGS methods
- The use of NGS technologies for exome sequencing in prenatal and neonatal diagnosis
- COVID-19 test development and validation



## Institute of microbiology and epidemiology

The study of the reproductive tract microbiocenosis and of <u>microbiota</u> of pregnant women and newborns

Development of new test systems

- medications based on lactobacilli and bacteriophages alternative to antibiotics
- Study of the distribution and intensity of circulation of strains of infectious pathogens
- Study of new molecular mechanisms of <u>drug resistance</u>
- Decoding the <u>bacterial genome</u>

## System Biology Department: Proteomics and metabolomics research; Bioinformatics; MicroRNA



Metabolomic profiling

tissue and liquids mass spectrometry analysis for diagnostics of various diseases: endometriosis, myoma, breast and cervical cancer

Joint project with East China Institute of Technology: Development of Mass Spectrometry Methods for the Instant and Noninvasive Diagnosis of Cervical Cancer.

Neonatology with Mass-spectrometry: Mass Spectrometry Analysis of Newborns Breath and Urine



Joint project with the Jiangxi Key Laboratory for Mass Spectrometry and instrumentation: Direct Metabolic Phenotyping of Newborns at the Molecular Level Using the High Resolution Mass Spectrometry Analysis of Exhaled Breath



## Laboratory of mitochondrial medicine

#### Goals:

Study of mitochondrial physiology in pathogenesis of human reproductive system diseases and in developmental disorders

#### Focus on:

- Preeclampsia
- Fetal growth restriction
- Premature delivery
- Endometriosis
- Metabolic reprogramming at neoplastic and tumor transformation
- Bioenergetics of gametes and reproductive tissues during lifecourse
- Premature ovarian failure
- Policystic ovaries









## Laboratory of cells molecular pathophysiology

#### Main trends: endometriosis, preeclampsia, fetal hypoxia

Workflow



In endometriosis lesions 13 differentially expressed miRNA were found compared to endometrium and

Simultaneous expression changes of miRNA in blood plasma and placentas on 25 and 39 gestation days: 6 up regulated and 1 down regulated.

#### Hypoxic-ischemic encephalopathy

miRNA analysis of blood plasma revealed 2 fold changes of 38 miRNA on 1<sup>st</sup> and 3d days after birth

The identified miRNAs have regulatory role in cell proliferation, differentiation, angiogenesis, inflammation, mitochondrial function, synaptic plasticity



## Laboratory of regenerative medicine

### Laboratory of cell technologies

- Development and introduction of methods of cell therapy and
- tissue engineering and other tools of regenerative medicine for pelvic floor, endometrium, vagina reconstruction





Isolation and characterization of
 Multipotent Mesenchymal Stromal Cells
 (MMSCs) of perinatal tissues

➢Isolation and characterization of extracellular vesicles (EVs) MMSCs

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### Assisted reproductive technologies and embryology labs

Growing of euploid blastocysts from immatureoocytes of patients with cancer *ex vivo* 

3D bioprinted ovarian construct

FLIM

(fluorescence-lifetime imaging microscopy) of mature sperm in real time

Embryo co-culturing with various cells Microvibration



Патология: головка ярко светится (гликолиз) NADH Норма: шейка ярко светится (окислительное фосфорилирование NADH), головка не светится











## **Bioinformatics laboratory**

- software package for omics data analysis and evaluation of laboratory studies
- methods for joint analysis of pathomorphological images and data of genetic tests
- Models for cancer metastases prediction

### Activities

#### ✓ Research

- The samples and collections are currently used for more than 20 research projects carried out by the Center and supported by several national foundations. Main users: the Center research staff; other institutions in the frame of joint projects
- In the international collaborative projects with:
  - Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden;
  - Center for Research in Cancerology and Immunology Nantes-Angers, France;
  - East China Technical University
  - The Westerdijk Fungal Biodiversity Institute, Utrecht, Netherlands;
  - International Network on Cancer, Infertility and Pregnancy (INCIP)
  - European Surveillance of Congenital Anomalies (EUROCAT)

✓ Tests validation (on request on manufacturers) – e.g. <u>kits for anti-SARS-Cov-2 antibodies detection</u>
 ✓ Development and validation of samples collection and storage protocols

# The Center is a unique integrity of clinical practice and scientific research

**Open for collaboration with the research teams in Europe** in the burning areas of medicine:

- high-risk pregnancy;
- adverse perinatal outcomes;
- infertility;

6\$D

gynecologic cancers and oncofertility

Keen to exchange with **European research infrastructures**, including:

- biobanks;
- disease registries;
- databases of laboratory and instrumental research

#### **Biobank**

- is the member of the National Association of Russian biobanks (NASBio)
- is considering joining ISBER
- Communications with BBMRI –ERIC
- Communications with Graz Biobank



### Access to the facility

**Remote:** televideoconferencing, access to databases and collections descriptions (to be discussed)

**Physical:** within a joint research project confirmed by a signed cooperation agreement or on personal contract.



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