Belarusian State University

Education, Research and Development Cooperation
Belarusian State University is a leading educational center in Belarus. Founded on October 30, 1921.
Belarusian higher education

history is closely connected with the history of Belarusian State University. 1390 students started attending classes in its three faculties: labor, medical and social sciences. Only 14 professors and 25 candidates of sciences (Ph. D) were among first lecturers.
Top level specialists are trained in BSU doctor, post-graduate and master courses. Annually the university trains 750 doctor and candidate applicants.

In 2008-2009 academic year

16 faculties and 4 educational institutes of BSU taught about 25 000 students in 57 specialties.
<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>7700</td>
</tr>
<tr>
<td>Teaching staff</td>
<td>2400</td>
</tr>
<tr>
<td>Scientific manpower and research engineers</td>
<td>1900</td>
</tr>
<tr>
<td>Doctors of Science</td>
<td>300</td>
</tr>
<tr>
<td>Candidates of Science (Ph. D.)</td>
<td>1400</td>
</tr>
</tbody>
</table>
University Belarusian State

Education
School-leavers training

BSU lyceum is a senior degree for pupils of 10-11-x forms. The lyceum makes purposeful selection of pupils and carries out work with those who showed exceptional abilities in natural sciences and the humanities. 24 specialized classes are available for 500 students including those living outside Minsk.

Law college:
Specialties:
State- and- legal activity, law-and-legal activity, economical-and-legal and personnel work
BSU Lyceum
For foreign nationals

Pre-university training faculty enables foreign students to learn Russian and adapt their knowledge to the system of education currently available in our university.

300 foreign nationals per year

Annually BSU gives education higher 750 - 800 post-university 65-70
Foreign nationals from 40 countries: Russia, Ukraine, Moldavia, China, Iran, Libya, Lebanon, Nigeria, Syria, Vietnam, and other
Faculties

- Mathematics and Mechanics
- Applied Mathematics and Informatics
- Radio Physics
- Physics
- Chemistry
- Biology
- Geography
- Economics
- Business and Management of Technology

- History
- Philosophy and Social Sciences
- Law
- International Relations
- Journalism
- Philology
- Humanities
- Military
- Management and Social Technologies
- Theology
Faculty of Geography
BSU students – winners of International Competitions

The team gained:
- 26 gold medals
- 18 silver medals
- 10 bronze medals
- 6 Grand Prix
- 3 absolute first places

Annual reaching the finals
- 2004 – Gold medals
- 2005 – Absolute team victory of all participants of competition in mathematics

IMC – International Mathematic Competition
ICPC – International Competition on Personal Computers
Master’s Programs of the SBMT

- **Master of Business Administration**
  A two year program corresponds to American standard of business school **MBA**. The language of instruction is predominantly English.

- **Master of Science in Logistics**
  Joint graduate program in cooperation with Molde University College, Norway. The language of instruction is Russian and English.

**Our Partners**
- USAID / Eurasia
- Swedish Institute
- Vaxjo University, Sweden
- Central Washington University, USA
- Molde University College, Norway
- Indiana University Northwest, USA
- Nebraska Lincoln University, USA
Educational process information support

- Distance learning system
- Free access to Internet resources
- Specialized information resources
  BSU Internet - networks
- Students self-checking testing system «Electronic university»

Over 48 km. of fiber-optic communications connect all educational and management buildings
High skilled specialists training

Specialties count

- Postgraduate course – 113
- Doctor’s course – 29
- Postgraduate students (PhD) – 700
Research-Innovation Structure

Faculties

Research laboratories

Research institutes

Applied Physical Problems

Nuclear Problems

Physical-Chemical Problems

Applied Problems of Mathematics and Informatics

Research centers

Particles and High Energy Physics

Ozone Monitoring

Hi-Tech enterprises

Human problem
- Nanostructures and nanotechnologies
- Elementary particles and high-energy physics
- Laser technologies
- Space research
- Theory of differential and integral equations
- Complex systems mathematical modeling
- Research in the field of development of new materials and technologies
- Biotechnologies and generic engineering
- Concept of macroeconomic stabilization in Belarus
- Juvenile law
- Development of National Atlas of Belarus
Four Centers of sharing use of unique research equipment are available in BSU

- Belarusian inter-university center of research facilities
- Center of sharing use of devices and equipment of faculty of biology
- Laboratory of physical-and-chemical methods of research RI PCP
- Center of nanotechnologies and physical electronics

CSP concentrates up to 70% of BSU’s total park of new expensive and unique equipment
RI of Applied Physical Problems named after A.N. Sevchenko

RI APP employs
- 236 researchers and engineers
- 17 doctors of science
- 34 candidates of science (Ph. D)
- 4 professors

Main directions
- Spectroscopy and luminescence
- Ultrasonic and electromagnetic waves
- Nuclear and powerful electromagnetic radiations
- Semiconductors and other materials for electronics and machine building
- Fast processes in applied tasks of physics
- Data processing measuring-calculating facilities
- Intelligent control systems
RI NP director- Barishevski V.G. – author of two discoveries of USS in the field of nuclear physics (№224 from 1979 and №360 from 1981 г.).

Institute has different international contacts and closes cooperates with United Institute of Nuclear Research (Russia), and is a collaborating member of CMS in CERN, DO and BTeV in FNAL (USA).

- Institute employs: 66 researchers and engineers
- 7 doctors and 20 candidates of sciences (Ph. D.)
RI PCP employs

- 164 researchers and engineers
- 7 doctors and 70 candidates of sciences (Ph. D.)

**Main directions**

- Nanocrystal, amorphorous, fine and composite materials
- Natural and synthetic polymers
- New medications
- Inorganic materials synthesis and modification.
- High-temperature electrochemical and electronic devices
- Magnetic, thermo- and wear-resistant coatings
- New organic compounds synthesis
- Extraction and sorption processes
The center employs:

- 41 researchers and engineers
- 3 doctors of science
- 7 candidates of science
- 2 professors

Main directions

- Theoretical and experimental research of fundamental interactions and structures of micro particles at high energies
- Methods of recording of micro particles at extreme conditions
- Organizational support of research carried out in United Institute of Nuclear Researches (UINR, Dubna, Russia) with participation of organizations and institutions of Republic of Belarus
RI of Applied Problems of Mathematics and Informatics

Staff: 24 researches including 2 doctor and 8 candidates of sciences. Over 60 BSU lectures, postgraduate students and students take part in the research of the Center.

Main directions

- Computer data analysis
- Mathematic modeling of complex systems, processes and phenomena in economics, engineering, ecology, medicine and other branches of national economy
- Software in the field of theoretical and applied informatics
- Mathematical methods of information security, cryptography
Main directions

- Development of measuring equipment for ozonosphere monitoring
- On-line monitoring, analysis, and forecast of ozonosphere condition and levels of surface ultraviolet radiation
- Taking measurements under BMO Global Atmosphere Watch
- Research in the field of ozonosphere physics, problems of ozonosphere preservation

The division employs 25 researchers
- 1 doctor of science
- 7 candidates of science
- 1 professor
Hi-Tech enterprises of the BSU

- **Unitehprom BSU** - Small-scale chemical and equipment production of various purpose
- **Unihimprom BSU** – Development of the technology of disel biofuel production from vegetable oils and other accompanying products
- **Unidragmet BSU** - treatment of man-caused waste containing precious and non-ferrous metals treatment
- **Adamas BSU** - Production of diamond monocrystals and instruments made of them
- **Engineering department of the special purpose technical division of the BSU** – Production of computers, traffic controllers and systems of traffic control, software & hardware for medical experts
- **Active BSU** – Production of training devices for physical experiment, vacuum engineering and forage additives
- **Sand BSU** – Production of tests systems for drug detection
Basic R&D products of the BSU

Hardware-software complexes, devices and equipment
- Hardware-software complexes
- Control instrumentation
- Medical devices
- High-end devices and integrated circuits
- Training devices, equipment, systems

Equipment and instrument

Substances and materials
- Industrial substances
- Protective substances and materials
- Medical substances and reagents
- Biopreparations

Technologies
- Biotechnologies
- Industrial technologies
- Information high-end technologies
- Information training technologies

More than 1000 items altogether
Basic fields of application

- Environmental protection and human ecology
- Agriculture and food production
- Resource and energy saving
- Medicine
- Small-scale chemistry
- Precious metals and stones
- Geo-information systems
- Statistical prediction
- Information protection
- Metal-working
- Oil prospecting and production
- Instrument-making
- Radio electronics
- Training
- Automated management systems
Microwave technologies and devices

WWW.BSUPRODUCT.BY
High-Q microwave resonators with eigen mode sparse spectrum

Millimeter-wave frequency range electronic tuning device

Microwave generators
High-rate wireless communication

Carrier frequency: \(~60\) or \(~90\) GHz
Transmission distance: \(~10\) or \(~15\) km
Transmission rate with linear modulation: up to 200 Mbit/s
Weight: < 2 kg

Analogs:

<table>
<thead>
<tr>
<th></th>
<th>MACT–1</th>
<th>AN/GRC-173</th>
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</thead>
<tbody>
<tr>
<td>Japan</td>
<td>39,3</td>
<td>38,5 GHz</td>
</tr>
<tr>
<td>frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>distance</td>
<td>4</td>
<td>3,7 km</td>
</tr>
<tr>
<td>rate</td>
<td>1,5</td>
<td>6 MBit/s</td>
</tr>
</tbody>
</table>

Transmitter unit
- output power 10…25 mW
- modulation bandwidth 10 kHz…200 MHz
- operating temperature range:
  - 40 … +50 C

Receiver unit
- input power 0,001…1 mW
- amplification factor 30 3 dB
- intermediate frequency: 0,8…2 GHz
EQUIPMENT FOR MICROWAVE STERILIZATION

The equipment to sterilize soil, compost, humus and other substrates is designed to extirpate weed seeds, fungus and bacteria pathogens, detrimental insects in these substrates preserving soil fertility.

The equipment includes a heating chamber, microwave modules and a control unit

- Capacity, tons per 24 hours: 2
- Power consumption, KWt.h: 8
- Flux density, mcWt/cm²: < 10
- Microwave modules count, pieces: 6
- Cost per unit power consumption, KWt.h/m³: 20
Microwave technology of presowing treatment for agricultural crop seeds

Plants
- Cucumber
- Tomato
- Cabbage
- Beet
- Carrot
- Barley
- Soybean
- Wheat
- Rye
- Perennial cereals grass
- Rape

Basic characteristics:
- 12-15% yield growth
- 15-25% germination rise
- Fungi infections suppressing

Belarus Patent № 5580 от 20.12.99,
IPK 6 A01 C 1/00, H 05 B 6/80
High effective equipment for wood drying

**Principle of operation - combined dielectric and convectional heating**

**Operating chamber volume**  
- from 2 m³ to 20 m³

**The wood drying takes place in a drying chamber under the influence of microwaves**

**Belarus patents**  
5107 (F 26B 3/347 ) 23.12.2002  
5274 (F 26B 3/347 ) 03.03.2003

**Project BSU-Korea**

Microwave equipment of industry scale for drying organic polymer materials
Control and Analytical devices
VSC is intended for operative remote monitoring of forest states, water ecosystems from the board of aircrafts.

The system is based on the latest techniques of remote spectroscopy and spectrozonal polarization image acquisition and processing.

It provides simultaneous image acquisition in 3 spectral zones (from 12 zones in visible and NIR spectral ranges) and operative interactive data processing with geographical registration.
The system enables inclusion of at least 128 meteorological, radiation sensors to carry out ecological monitoring of the territories at each automatic control station.

The system is maintained by 1-2 persons per shift.
Hardware and software complex of Gamma-AT is intended for real-time environmental and area radiation monitoring of radiation-dangerous and radiation-sensitive targets and sending data with meteorological parameters to control centers.

**Structure of the system**

- Gamma-AT is a network of distributed on 40-60 kilometers automatic measuring points (AMP)
- Local control center (LCC)
- Regional control center (RCC)
- National control center (NCC).
COMPUTER-AIDED SYSTEM
TO CONTROL CITY TRAFFIC

The system includes:

• Cross-roads control system, operating on the basis of custom computers, having domestic manufacture certificate

• Traffic controllers DUMKA

• Traffic lights including intellectual ones

• Smart panels for pedestrians

• Software to control traffic

ISO-9001 certifies manufacture equipment in total
Training devices for physical experiment

Training technology
  Computer-aided experiment

37 facilities

Software and hardware complexes and laboratory equipment to provide laboratory practicum in all sections of physics in secondary and higher schools
Measuring Multifunctional Devices for Radio-electronic

- Digital oscilloscopes
- Arbitrary waveform generators
- Multichannel logic analyzers/generators
- Digital acquisition systems
- Precision systems for time analysis
- Instruments for measuring and analysis:
  - acoustic noise
  - vibration
  - surface roughness and circularity

Expansion boards for PC

UNIPRO
Automatic control systems to control engineering procedures in pulp and paper, textile and chemical industries Akvar

- Automatic control systems to control the profile of humidity and mass of paper sheet
- Microwave measuring device to measure paper and cardboard sheet humidity «Akvar-1102»
- IR measuring device to measure humidity of sheet and loose materials of reflective type «Akvar -1108»
- Microwave measuring device to measure paper and cardboard humidity «Akvar -1205»
- IR measuring device to measure humidity and mass of paper sheet «Akvar -1206»
- And other
Analytic control-measuring devices for oil products quality control

- Oil flash temperature registration device VSPYSHKA
- The automatic analyzer of oil products fractional structure AFSA
- Thermostatic measuring device for oil viscosity measurements THERMOSTAT-A2
- Thermostatic measuring device for defining soluble gums in oil products POS
- Automated measuring device for determining flow temperature of oil products ITT
- Etalon temperature measuring device ITE
- Subambient thermostat KRYOSTAT
Multi-channel system for technical equipment condition control

System is designed for control and diagnostics of technical condition industrial equipment for various application: engines, turbines, compressors, pumps, toothed gears, assembled multistep reductors, etc.
Equipment and instruments

Technologies for Industry
Artificial diamonds manufacturing procedure, theromocuring

ADAMAS BSU is the largest in Europe specialized enterprise to manufacture synthetic diamonds for various-purposes: instrumental, tool, jewelry.
UNIDRAGMET

- Technology of extraction of gold, silver and other precious metals form man-made wastes
- Technology of obtaining salts and compositions containing precious metals
- Modern technologies of precious metals analysis

Gold reserves of Republic of Belarus
Complex sets for production of various articles from polyurethane foam

- Heat-insulated articles
- Filtering articles
- High-temperature condensing materials
New substances and materials & technologies of their production
PENOPORUM absorbs oil and mineral oil at 35-70 times more than its own weight without change of volume and is used for gathering liquid oil products and organic substances at liquidation of emergency oil outflow, clearing water areas, soil, sediment tanks, storm sewage of hydrocarbons and their derivatives, crude oil, heavy and easy grades of fuel, vegetable, animal and mineral oils, organic solvents and ordinary organic products.
Multi-regenerated Tekma - filters

- **Viscose filter** cloth is resistant to organic solvents (acetone, alcohols, dimethyl formamide, chlorinated alkanes).
  Retaining ability - 5 μm.
- Polyether filtering cloth is resistant to microorganisms, acids, bases of middle concentrations, organic solutions.
  Retaining ability 10 and 100 μm.
Technology of obtaining drinking water from polluted water sources in emergency situations

- **Personal portable kit**
  - 10-100 $dcm^3$ of drinking water in 10-15 min
- **Mobile autonomous water purification unit**
  - 2500 $dcm^3$ of drinking water in 3 hours

For polluted water purification from:
- microbiic infection, including viruses
- dissolved organic and chlororganic substances, active chlorine
- colloid particles, containing heavy metals
- suspended particles (sand, clay, etc.)
THERMO-RESISTANT GLUE PRODUCTS

Steady to thermocycling up to 1700 °C. Differ from other analogues by lowered temperatures of hardening

Some of the compounds were successfully used in constructions of the «Energia-Buran» space ship

- Fillers
- Compounds

Thermo-resistant materials on the basis of phosphate binding compositions: materials, compounds, coatings, glues
Functional and decorative metallization

- Metallization of radio-engineering ceramics
- Process of thick-layer chemical copper plating
- Metallization of functional piezo-ceramics
- Aluminum nickel-plating
- Chemical sedimentation of gold coatings
- Black conducting and semiconducting coatings
- Electrochemical sedimentation of nickel-boron compounds instead of gold and silver
- And other
Deposition of Metal Coatings from Solutions

**Chemical deposition of metals and alloys**
- Ni, Ni-P, Ni-B, Cu, Sn, Co-B, Ni-W-P, Ni-Mo-P, Ni-Pd, Ag, Au, Pd

**Electrochemical deposition of metals, alloys and composites**
- Cu, Ni, Zn, Sn, Au, Sn-Au, Cu-Sn, Cu-Ni, Cu-Zn, Ni-P, Ni-B, Ni-Sn, Ni-Zn, Ni-W, Ni-Mo, Ni-Co-(B), Ni-Fe-(B), Ni-WO₃, Ni-MoO₃, Ni-SiO₂, Ni-diamond

**Chemical oxidation, electrochemical deposition**
- CuO, NiO, CuS, Cu₂O

### Substrates

- **On dielectric substrates**
  - glass and quarts
  - ceramics (Si₃N₄, AlN, Al₂O₃, SiO₂)
  - polyimide, polyamide
  - polystyrene, ABS-plastic
  - polyethylene terephthalate
  - polycarbonate

- **On conducting substrates**
  - Cu and its alloys
  - Al and its alloys
  - steel, gray iron
  - Zn and its alloys
# Technology of diesel biofuel production on the basis of rape-seeds

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density at 20°C, kg/m³</td>
<td>886</td>
</tr>
<tr>
<td>Heating value, J/g</td>
<td>39670 ± 4.5</td>
</tr>
<tr>
<td>Flash point, °C</td>
<td>138</td>
</tr>
</tbody>
</table>

- Valuable accompanying products: solid fuel, oilcake to prepare forages, technical soap, glycerin.
- Low amount of sewage, absence of gaseous emissions.
- An opportunity to organize small-scale plants directly in places of diesel biofuel consumption.
Polyelectrolyte gel for incrustation of agricultural crops seeds Gisinar

- Provides crop yield by 4-6 c/ha at average productivity making 30- 40 c/ha

- Polyacrylonitril fibers wastes have been used as a source material to produce hydrogel B

- Polyelectrolyte gel «Gisinar» production is wasteless and environmentally friendly

- Retains humidity

- Output of various forms of the preparation with active additives: herbicides and fertilizers
Medical devices

Medical substances and biopreparations
LEDIS – medical diagnostic system

Spirometer MAC – a device for patient’s respiratory system condition assessment; measures and calculates over 20 parameters of breath, interprets the results including pharmacology tests.

HF-puncture
Laser-puncture
Electro-puncture
Universal surgical three-wave laser apparatuses

- Hyperthermia, coagulation, hemostasis
- Contact tissues dissection with simultaneous coagulate effect
- Tissues dissection with narrow cut width and small necrosis area
- Vascular pathologies therapy

Laser three-channels radiation on biological objects enables the surgeon to use one and the same apparatus to make unique surgical operations of various classes.
Fast-dissolving pharmaceutical substances on the basis of cellulose derivatives and carbonic sorbent possess higher sorption ability in relation to hazardous substances and products of their decomposition - toxins.

Tablets of Black antiacid (1) and “Rennie” (Switzerland) (2), containing 0.1 M HCl
Medical products on the basis of modified polysaccharides

Manufacture of napkins, ointments, powders and injections for external and implantation applications.

The basis of medical preparations is the oxidized cellulose containing immobilized on it antibiotics, immune-stimulants, ferments.
Drop-color reactions, used in tests, allow to detect narcotics within 2-10 minutes.

Main features are safety of the analysis procedure and low cost.

Test-systems to detect drugs and psychotropic substances

Test-systems to evaluate food products quality
Medical diagnostic sets

• Sets of reagents and solutions for biochemical and hematological research

• Diagnostic express-systems

• Various reagents
NEW GENERATION FOOD

• Technological additives to improve flour quality
• Bakery and confectionary enrichment additives
• Vitamin-mineral premixes
• Gluten-free mixtures
• Cosmetology phytocomposition

About 50 phytoadditives have been developed and produced
Optimal dosage makes 2 - 4 % of product weight

Natural food additives

Functional ingredients: food fibers, vitamins, mineral, bifidobacterium substances, amino acids
Veterinary medications to cure animal’s microelements

**Use:** peroral application in cattle breeding for pigs, cattle and others
Veterinary medications include microelement with amino acid fragment.

**Veterinary medications include microelement with:**
- cobalt – **COBALVET**
- iron - **FERROVET**
- copper - **CUPROVET**
- zinc - **ZINCOVET**

Water-soluble colored powders. By Customer’s request can be presented as assigned concentration aqueous solutions.

**Advantages:** The medications are health friendly, non-toxic, non-irritants, free from sensibilization, embryotoxicity, teratogenicity and non-mutafacient.
Biological preparations for plants protection from bacteriosis, fungi infections and nematodes
STABILIZED FOOD LINSEED-OIL

- Prolongation of the storage period (shelf-life) up to 16 months
- Preservation of nutritious and medical properties of oil, high contents of vitamin E and phytosterols
- Absolute safety of the vegetable stabilizer, its availability and low cost
- Enrichment of oil by a complex of nutritious and biologically active substances contained in the stabilizer, in particular, by group B vitamins
IT - technologies
Medical expert systems

Ortho Expert – system to maintain solutions in orthopedy

• Information-encyclopedic data on methodologies, examination, treatment and anatomy: anatomic atlas contains 130 illustrations with descriptions

• Diagnostic process from examination to the selection of spine, upper and lower limbs pathology treatment strategy

• Includes data to diagnose upper limbs treatment – 100 diagnoses, lower limbs – 123, spine diagnoses - 44 diagnoses

Technology of surgery operations preparation and making
• STATISTICAL FORECASTING
• ECONOMIC MODELING AND PREDICTION
• EVALUATION AND OPTIMIZATION OF THE CHARACTERISTICS OF COMMUNICATION NETWORKS
Information technologies in education

- Mathematical statistics
- Economic modeling and prospecting
- Crypto Laboratory
- Informatics for programmers
- Mathematics for higher school
- Mathematics for non-mathematic specialties of colleges and universities
- Russian language in tests and commentaries
- Icon painting masterpieces of Belarus in XII-XVIII centuries.
Geographic information systems

Solid mineral resources, oil and gas

Ecology monitoring

- Corporate system of mine design and control
- Geomechanical and ecological monitoring
- Data entry, editing, digitizing
- Hardcopies plotting
In 2008 developments of the BSU were sold to 26 countries of the world in accordance with 83 contracts.
International co-operation
In 2008 new scientific-and-industrial products developed in BSU were marked with awards at international innovation competitions:

- 12 gold
- 5 silver
- 8 bronze medals
- 18 diplomas
Welcome to Belarus!

The Republic of Belarus is located in the eastern part of Europe.

In the west it borders on Poland, in the northwest – on Lithuania, in the north – on Latvia, in the northeast and east – on Russia, in the south – on Ukraine.

Belarus’ population numbered 10 millions people.

Belarus’ area is 207.6 thousand square kilometers.

Agricultural lands occupy 45% of our territory, including 30% of tillage. Forests cover 36% of the area.
Contacts

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