Altai State University, Barnaul, Russia

Sergey V. Zemlukov, Rector
Barnaul is a Center of South Siberian Region
Big Altai
Altai State University

- founded in 1973
- in the list of the 30 best universities of Russia
Altai State University

- 16 faculties
- 6 branches
- 3 research institutes
- 12 interdisciplinary research and educational centers
Altai State University

- 18 research laboratories
- Scientific museums
- Art gallery
- 14 centers for retraining
- Botanic garden, the biggest in the South West Siberia
Altai State University

- University Library (3 million books)
- A branch of the First President Eltsin Library
- Publishing House

The Governor of Altai Region A. Karlin is opening a branch of the First President Eltsin Library at ASU
Altai State University

- 157 bachelor programs
- 102 master programs
- 61 postgraduate and doctoral programs
Altai State University: International Cooperation

➢ 75 agreements of cooperation with 50 international universities, mainly from Asia and Europe

➢ 300 international students

➢ Over 150 international professors and researchers visited ASU this year
Altai State University is a member of the University of Shanghai Organization of Cooperation (+60 leading national universities from China, Kazakhstan, Kirgizia, Russia and Tajikistan)

9.10.2012: ASU got a status of a member of the University of Shanghai Organization of Cooperation

Rector Prof. S. Zemlyukov is signing the Memorandum of the USOC
Association of Asian Universities

The main goal of the Association is to promote joint activities and multi-format collaboration among higher educational institutions and formation of a common scientific-educational and humanitarian space in Asia, leading to the achievement of a cooperative effect in international educational community.
Altai State University: Germany as a primary vector for cooperation

- History of Altai region
- Cultural, educational and economic cooperation between Altai region and German territories and universities
Welcome to Altai State University
Welcome to Altai State University

International Russian-American Science & Education Centre of «Nano - Bio - Design and Technologies»

IRASEC is offered to create on the basis of ASU (Barnaul) at assistance ASU (Phoenix) on the assumption of some offers from Institute of Bio-Design ASU (Phoenix) and from natural faculties of ASU (Barnaul)

Structure of IRASEC of «Nano - Bio - Design and Technologies» includes 5 scientifically-educational divisions:

Nano-Bio- Engineering. Leader from ASU (Barnaul) : Prof., Dr. of Phys Sci. Beznosyuk S.A.

Nano-Bio- Medicine. Leader from ASU (Barnaul) : Prof., Dr. of Biol. Sci. Sokolova G.G.

Nano-Bio- Pharmaceutics. Leader from ASU (Barnaul) : Prof., Dr. of Chem. Sci. Bazarnova N.G.

Nano-Bio- Ecology. Leader from ASU (Barnaul) : Prof., Dr. of Biol. Sci. Silanteva M.M.

Nano-Bio- Energetic. Leader from ASU (Barnaul) : Prof., Dr. of Biol. Sci. Shmakov A.I.
A number of computational chemistry designs are directed on creation of new ranges of application in engineering chemistries, for example, in nanotechnological engineering of graphene nanocheaps.
Nano-Bio- Engineering Division

PROJECT 1
Computational Chemistry and Biomimetic Nanosystem Design

Several nanotechnology projects aimed at creating new applications of biomimetic nanosystem design in multi-level technologies fuel cells and catalysis. For example, nanographene sheets (A) can be utilized for designing submicronic pores – nanoreactors of self-assembly and self-organizing of biomimetics nanosystem of carbone nanogel (B), which contains in its turn nonporous for self-assembly and self-organizing of nanometre-sized fractal catalytic clusters (C) of active atomic particles (D).
The research of the infusion subsystem of detonation nano-diamond and the development of modification methods for biological and technical use.

Infusion subsystem of detonation nanodiamonds

Detonation nanodiamond, obtained by detonating of carboniferous explosives, is made up of nanoparticles with the size of 4-6 nm of condensate of carbon atoms, having diamond crystalline grid.

The density of the substance is 3,09 g/cm², BET surface area — 319 g/cm².
Nano-Bio- Engineering Division

PROJECT 2

The research of the infusion subsystem of detonation nano-diamond and the development of modification methods for biological and technical use.

Crystals of detonation nanodiamond

- Nanodiamond crystals equiaxed and have similar size, no crystals are elongated.
- Clearly visible cut - a form of many crystals in projection on a plane close to the hexagonal pattern.
- Size bulk crystals vary within a narrow range of 3 to 12 nm.
- The most common size of about 6 nm.
**Nano-Bio- Engineering Division**

**PROJECT 2**

The research of the infusion subsystem of detonation nano-diamond and the development of modification methods for biological and technical use.

Molecular complexes of infusions subsystem detonation nanodiamond

<table>
<thead>
<tr>
<th>m/Z</th>
<th>18</th>
<th>17</th>
<th>16</th>
<th>36</th>
<th>64</th>
<th>16</th>
<th>44</th>
<th>28</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element or molecular cluster</td>
<td>H₂O</td>
<td>HO</td>
<td>CH₄</td>
<td>H₂S</td>
<td>SO₂</td>
<td>O,</td>
<td>CO₂</td>
<td>N₂ or CO</td>
<td>H₂</td>
</tr>
<tr>
<td>temperature range, °C</td>
<td>40-200</td>
<td>40-200</td>
<td>180-320</td>
<td>480</td>
<td>200-580</td>
<td>530-780</td>
<td>500-820</td>
<td>690-820</td>
<td>680-900</td>
</tr>
</tbody>
</table>

- **In the temperature range from 30 to 1000 °C is the desorption of molecular clusters.**
PROJECT 1. «Diagnostics and prognosis of cardiovascular diseases»

CVD is the leading cause of death worldwide. Identifying people at the preclinical stage is the most important task of medicine.

It can be performed in several ways:

- to predict coronary risk
- to detect markers of endothelial function affection.
1. Computer programs are being developed for prediction of cardiovascular complications in the coming years forecasted by SCORE, PROCAM, Framingham indexes.

Doctors workplaces are connected through a shared server in a single system, which allows to create a common population database, to form risk groups and assign early preventive measures.
Some of the computer programs have been tested in several medical preventive institutions. The results are published in the Russian journals, congresses and conferences materials as well as EuroPRevent materials (Dublin, Ireland, 2012), 80th European Atherosclerosis Society Congress. (Milan, Italy, 2012), CMReJournal, Abstract Book of The 3rdInternational Congress on Abdominal Obesity (Quebec, Canada, 2012).
A complex program of diagnostics and prognosis of cardiovascular diseases (CVD) is performed with the participation of employees from three Altai region universities –

Altai State University (Dr. of biological sciences, professor G.G. Sokolova, Ph.D. in biology, associate professor E.A. Sharlaeva)

Altai Medical University (Dr. of medical sciences, professor E. N. Vorobyev, Ph.D. in biology, A.S. Kazyzaeva, R.I. Vorobyev, V.A. Leshchenko, I.G. Leshchenko, D.S. Bublikov, A.G. Koblov, etc.)

Altai Technical University (the team leaders are Dr. of technical sciences, prof. O.I. Pyatkovskiy, Ph.D., associate professor A.S. Avdeev).
2. Alongside with traditional risk factors such as markers of endothelial dysfunction the following risk factors - circulating desquamated endothelial cells (phase-contrast microscopy, followed by photography) are determined within the population groups of moderate, high and very high risk as classified by SCORE.

In addition, predictors of cardiovascular complications such as osteoprotegerin, neopterin, and other indicators (hsCRP, lipids and lipoproteins, apoproteins) are defined. These indicators can be used for early diagnostics of atherosclerosis, predict complications and assess the effectiveness of preventive measures. The results are published in the Russian journals, materials of congresses and conferences.
Project 2. Research of human genetic and contagious diseases

The project aims at test systems creation (including DNA-chips) for identification of human genetic diseases, tuberculosis strains and strains of other contagious diseases. The work can be done together with Institute of Chemical Biology and Fundamental Medicine SB RAS (Novosibirsk). The work will be conducted in bioengineering laboratory at ASU and in the laboratory of Institute of Chemical Biology and Fundamental Medicine.
Nano-Bio- Pharmaceutics Division

Project 1 Preparation of modified nanocellulose

- environmentally friendly delignification
- chemical modification

soluble nanocellulose for medical and pharmaceutical applications
Processes for obtaining cellulosic materials directly from plant raw materials

Chemical treatment of plant raw materials with hydrogen peroxide, peracids, ozone

- **purified cellulose**
  - Crystallinity index – 70%
  - Transverse dimension of the crystallites – 3 nm

- **hydrated cellulose**

- **oxidized regenerated cellulose**
  - Degree of polymerization – 40
  - Solubility in water – 95%
  - Low crystallinity

- **microcrystalline cellulose and cellulose nanocrystals**
  - Crystallinity index – 70%
  - Transverse dimension of the crystallites – 3 nm
Supramolecular complex formation between biopolymer and drug

- Biopolymer
- Mechanochemical treatment
- Drug
- Prolonged action

Supermolecular interaction
Nano-Bio- Pharmaceutics Division

PROJECT 2

The purpose of the project – development and implementation of microclonal reproduction technologies for medical plants with high concentration of physiologically active substances with designated effects in the course of herbal raw material cultivation for pharmaceutical industry.
Nano-Bio- Pharmaceutics Division

**Appropriation:** biological diversity preservation, resource-efficient technologies development for obtaining and usage of economically valuable herbal raw material.
Nano-Bio- Pharmaceutics Division

The laboratory of plant biotechnology in ASU will adapt and develop the microclonal reproduction technologies for medical plants (Rhaponticum carthamoides, Empetrum nigrum, Potentilla alba, Potentilla erecta, Rhodiola rosea, Hedysarum neglectum) with the aim of planting material production for pharmaceutical companies.
Nano-Bio- Ecology Division

PROJECT 1
Reconstruction of Nature Environment
KULUNDA
Nano-Bio- Ecology Division

Reconstruction of Nature Environment
Reconstruction of Nature Environment

Monument of archeology of an epoch eneolit Novoili nka-3 (Burlinsky area, Altay territory)
PROJECT 2 The research of consequences and phenomena of global climate change in the comparative time aspect in Arizona and in South Siberia

- The project aims at the research of desert advancing phenomenon in the steppes of Southern Kulunda, vegetation change in the Altai Mountains
- Silantieva M.M. (Dr. of Biological Science, Professor), Shmakov A.I. (Dr. of Biological Science, Professor)
Nano-Bio- Energetic

- PROJECT 1: Research of Siberian cyanobacteria diversity as a component for alternative energy station.
PROJECT 1: Biodiversity research in Siberia and the Altai Mountains

- Colleagues from Arizona State University study the cyanobacteria productivity as the sources of biofuel in ordinary and extreme conditions. We are able to organize the research on gathering species, composites, and strains of bacteria that grow on the territory of Siberia in different ecological niches: in hot springs, in cold highland environment, in water reservoirs of different contamination and trophicity levels. The research of cyanobacteria as components of lichen is also possible. The collection of cyanobacteria can be studied in Altai State University as well as in Arizona. Field research on cyanobacteria diversity can be conducted using the expeditionary equipment of South Siberia botanical garden at ASU.

- Project manager – Shmakov A.I. (Dr. of Biological Science, Professor)
semi-desert areas of the Altai occupy 10%
Welcome to Altai State University

THANK YOU FOR ATTENTION!