UNIVERSITY OF NOVI SAD

FACULTY OF SCIENCES

SCIENTIFIC RESEARCH

at the Faculty of Sciences

– REPRINTED –

Novi Sad, 2011

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FACULTY OF SCIENCES

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CIRCULATION

500

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WORD of the DEAN

The Faculty of Sciences is one of the most important institutions which has been recruiting scientific potential of this country in the fields of natural and mathematical sciences for more than forty years. For four decades, The Faculty of Sciences has been implementing its mission in science and education through transferring, acquiring and promoting knowledge and science, and has produced educated, creative and open-minded young experts who are critical thinkers. More than 9,000 students graduated at the Faculty of Science, and 500 acquired a PhD degree. The aim of the Faculty is to maintain the position of the most important scientific basis in the fields of natural and mathematical sciences, therefore quality policy is the basic element of our development strategy.

The Faculty comprises five Departments conducting educational and scientific activities in the fields of: biology and ecology, chemistry, biochemistry and environmental protection, physics, meteorology, astronomy, mathematics and informatics, geosciences and management in tourism and hospitality. Despite being separate, all the Departments are connected into a unified interdisciplinary network which ensures that quality scientific personnel with more than 300 doctors and modern equipment are used optimally in order to produce outstanding scientific results. This is also confirmed by the quantity of scientific publications in 2010, when about 1,000 scientific papers were published with almost 300 being published in international journals on SCI list. According to these results, the Faculty of Sciences is among leading faculties in Serbia. Professors and assistants of the Faculty of Sciences are positioned on the top of the list of most cited researchers in Vojvodina, and among the top 30 most cited researchers, 20 belong to the Faculty of Sciences.

Scientific and research work at the Departments is conducted within various activities. Most frequently, research is conducted within scientific projects financed by relevant Ministries of the Republic of Serbia and the Autonomous Province of Vojvodina, and there are almost 100 of them, with 43 being supervised by the Faculty. Reaching global and European standards in science and education are basic aims that this Faculty is striving for. This is why, in addition to human resources, it is important to provide conditions for achieving top results, which requires the improvement of infrastructure, information

PRIRODNO-MATEMATIČKI FAKULTET
1969
NOVI SAD

system development, supplying modern and major equipment. This can only be achieved through participating in the international community and international projects. In 2011, the Faculty has participated in the realisation of 29 projects, among which are those most important ones from the FP7 project calls, IPA projects, Tempus projects, bilateral projects. Opening towards Europe and the world in the fields of science and education is one of the most important priorities of the Faculty of Sciences, which means that knowledge will be assessed through international cooperation at every level.

Connecting science with the economy and industry, in compliance with the development strategy of the country, is perhaps the most important task we should be striving for. Although the Faculty has a large number of signed agreements of scientific and technical cooperation with numerous institutions in the country and abroad, a real verification of scientific results can be achieved if they find their application in the economic development of the country. This is our mission in the future.

This monograph gives an outline of current scientific research that is carried out at the Faculty. They reflect not only global trends in science but also specific characteristics of our environment. From abstract mathematical and physical phenomena, to completely comprehensible problems related to the preservation and protection of the environment and the development of tourism in Vojvodina. And, in between, there is a range of fundamental and applied research studies, interesting ideas, diverse methods for finding solutions. But, the most important ones are researchers from the most eminent and experienced scientists to the youngest researchers, doctoral students, who work together and are adorned with enthusiasm, creativity, an abundance of ideas, and, most importantly, their mutual love for science.

With this publication, we wish to introduce our Faculty to scientists around the world, and we are certain this will produce some new ideas and establish new scientific cooperations. There should be no boundaries for science, and it will be possible to adequately develop only through partnership and exchange of knowledge and ideas. Without intensive development, a society will not have a future in the 21st century and it will not be ready to follow rapid technical and technological changes in the development of modern mankind.

Prof. Neda Mimica Dukić, PhD, Dean

DEANS OF THE FACULTY OF SCIENCES

- Prof. Mirko Stojaković, PhD
  Institute of Mathematics, 1969-1971
- Prof. Bogoljub Stanković, PhD
  Institute of Mathematics,1971-1973
- Prof. Branislav Bukurov, PhD
  Institute of Geography, 1973-1975
- Prof. Melanija Obradović, PhD
  Institute of Biology, 1975-1977
- Prof. Slobodan Carić, PhD
  Institute of Physics, 1977-1979
- Prof. Jevrem Janjić, PhD
  Institute of Physics, 1979-1981
- Prof. Slobodan Glumac, PhD
  Institute of Biology, 1981-1983
- Prof. Nada Perišić-Janjić, PhD
  Institute of Chemistry, 1983-1985
- Prof. Dragoslav Herceg, PhD
  Institute of Mathematics, 1985-1987
- Prof. Ištvan Žigrai, PhD
  Institute of Chemistry, 1987-1989
- Prof. Ištvan Bikit, PhD
  Institute of Physics, 1989-1991
- Prof. Rade Davidović, PhD
  Institute of Geography, 1991-1996
- Prof. Ištvan Bikit, PhD
  Institute of Physics, 1996-2000
- Prof. Pavle Tomić, PhD
  Department of Geography, Tourism and Hospitality Management, 2000-2005 (to February 4. 2005)
- Prof. Katarina Surla, PhD,
  Acting Dean, Department of Mathematics and Informatics from February 10 to April 14, 2005
- Prof. Miroslav Vesković, PhD
  Department of Physics, April 14, 2005 to September 26, 2008
- Prof. Slavka Gajin, PhD,
  Acting Dean, Department of Biology and Ecology, September 27, 2008 to September 31, 2009
- Prof. Neda Mimica Dukić, PhD
  Dean, Department of Chemistry, Biochemistry and Environmental Protection
  October 1, 2009 –

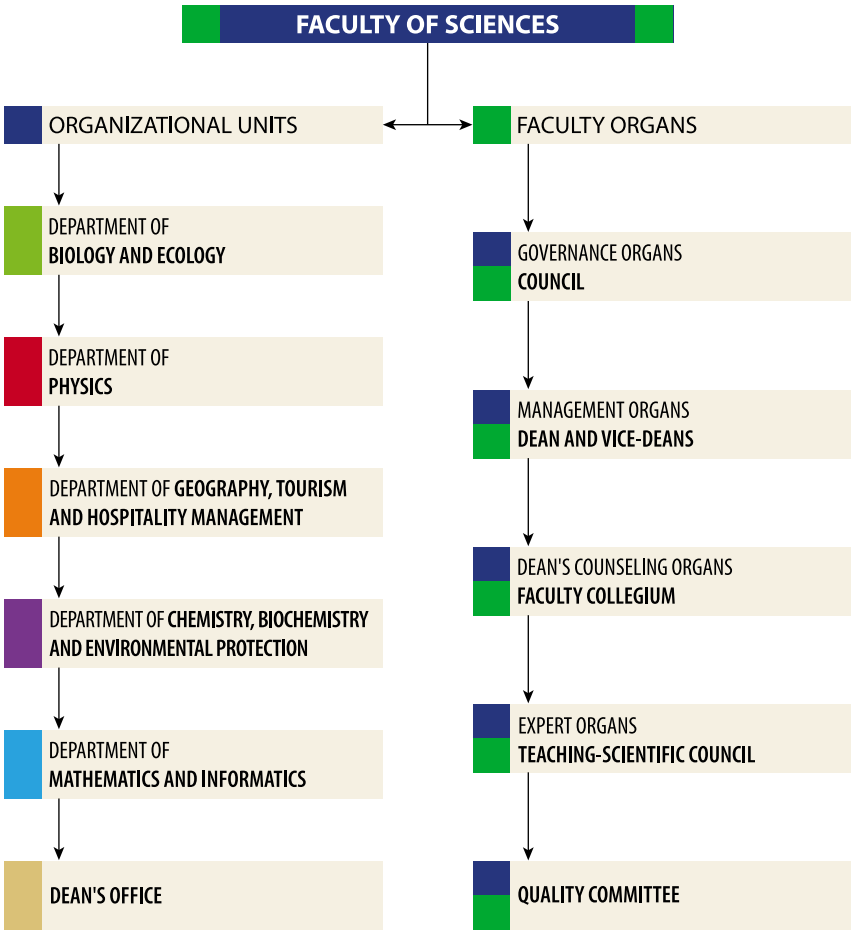
FACULTY OF SCIENCES

HISTORY

On July 9, 1969, the Assembly of the Autonomous Province of Vojvodina approved the Decision of the Faculty of Philosophy of May 22, 1969 on the founding of the Faculty of Sciences. Before that, the disciplines of natural sciences and mathematics had been taught at several faculties, and the academic year 1961/62 was the year of founding the following University departments: Department of Physics and Mathematics, Department of Chemistry, Department of Biology, and Chair of Geography at the Faculty of Philosophy. In January of 1976, the decision was passed to include University departments into the Faculty of Sciences, simultaneously Basic Organizations of Associated Labour as the Faculty Institutes of Mathematics, Biology, Physics, Chemistry, and Geography (in the terminology of that time) were formed. A further step was the integration of fundamental disciplines of the Faculty of Technology, Faculty of Medicine and Faculty of Agriculture of the University of Novi Sad into the institutes. During 1989, spatial development of the Faculty of Sciences was completed by constructing the 'Blue Building', located between the Institute of Mathematics and Physics and the Institute of Biology, to house the Institute of Chemistry, the Institute of Geography, and the Dean's Office.

After the innovation of the Law of University in 2003 (Official Gazette RS 21/2002), the institutes obtained a new status and were named departments. Thereafter the Faculty consists of five departments:

- Department of Biology and Ecology,
- Department of Physics,
- Department of Geography, Tourism and Hotel Management,
- Department of Chemistry, Biochemistry and Environmental Protection, and
- Department of Mathematics and Informatics.



Organizational Scheme of the Faculty of Sciences

EMPLOYEES

According to the data of November 2011, the overall number of people employed at the Faculty of Sciences was 535, of which 356 were members of the teaching staff (104 full professors, 36 associate professors, 74 assistant professors, 36 teaching assistants, 40 junior researchers, and 45 research associates).

INTERNATIONAL COOPERATION

Intensification of international cooperation and activities in the domain of Faculty internationalization are part of the Faculty mission and strategy for the fastest integration into the European educational and research space. Activities of international cooperation encompass visiting and research sojourns at foreign research institutions and universities, visits of foreign researchers and visiting professors, mobility at all levels that at the same time contribute to the advancement of both teaching and research work. Cooperation and contacts are established in the region, Europe, and worldwide, and the Faculty should make the best out of it for the enhancement of its capabilities for participating in the international research projects. Particular research groups participate already traditionally in submitting proposals for international projects, and the goal is to strengthen these groups and get people trained for the participation in the international competition.

RECTORS AND VICE-RECTORS OF THE UNIVERSITY OF NOVI SAD FROM OUR FACULTY

- Prof. Slobodan Glumac, PhD
  Vice-Rector, 1971-1973
- Prof. Slobodan Carić, PhD
  Vice-Rector, 1973-1975
- Prof. Miroslav Pavlov, PhD
  Vice-Rector, 1975-1977
- Prof. Bogoljub Stanković, PhD
  Rector, 1977-1979
- Prof. Jevrem Janjić, PhD
  Vice-Rector, 1987-1989;
  Rector, 1989-1991
- Prof. Dragoslav Herceg, PhD
  Rector 1991-1996
- Prof. Olga Hadžić, PhD
  Rector, 1996-1998
- Prof. Miroslav Vesković, PhD
  Vice-Rector, 2002-2004
- Prof. Dragoslav Petrović, PhD
  Vice-Rector, 2004-2006
- Prof. Branislav Djurdjev, PhD
  Vice-Rector, 2006-2009
- Prof. Miroslav Vesković, PhD
  Rector, since 2009

MEMBERS OF ACADEMIES OF SCIENCES FROM THE FACULTY OF SCIENCES

- Dr Bogoljub Stanković, Full Member of the Serbian Academy of Sciences and Arts (SASA)
- Dr Mileva Prvanović Full Member of SASA
- Dr Olga Hadžić, Full Member of SASA
- Dr Stevan Pilipović, Corresponding Member of SASA
- Dr Endre Pap, Full Member of the Vojvodina Academy of Sciences and Arts (VASA)
- Dr Ferenc Gaál †, Corresponding Member of VASA
- Dr Vukadin Leovac, Corresponding Member of VASA
- Dr Nada Perišić-Janjić, Corresponding Member of VASA
- Dr Bratislav Tošić Corresponding Member of VASA
- Dr Pavle Tomić †, Corresponding Member of VASA
- Dr Branislav Bukurov †, Full Member of SASA
- Dr Bela Ribar †, Full Member of SASA and Full Member of VASA
- Dr Mirko Stojaković †, Full Member of SASA
- Dr Miloje Sarić †, Full Member of SASA
- Dr Milan Čanak †, Corresponding Member of SASA

Only in 2008, more than 200 members of the Faculty of Sciences participated in the international scientific meetings, 67 in domestic meetings, and there were even 53 visits of researchers from abroad. This is the best indicator of the rich scientific activities of the researchers from the Faculty of Sciences in Novi Sad.

TOKENS OF RECOGNITION AND AWARDS FOR SCIENTIFIC ACHIEVEMENTS

- ***The Saint Sava's Award*** for special contribution to the development of education in the Republic of Serbia in 2008.
- ***EduBusiness Partner Award*** for 2008.
- ***The Captain Misa Anastasijevic Recognition***.
- ***Plaquette of Gratitude*** on behalf of the organization AYUSA *International - Cultural Exchange*, for the former and future cooperation in the field of students' exchange.
- Donation from the ***HP program "Technology for Education"*** within the *HP Philanthropy Program* (for founding and putting into operation of the Hewlett Packard mobile laboratory).
- ***The Pupin Prize*** of the *Matica Srpska*, which is awarded to young researchers for top achievements in the area of natural sciences and mathematics and technical sciences, the fields in which the world-known scientist Mihajlo Pupin was involved in. This prize was awarded to:
  - *Mr Đorđe Herceg*, MS, First prize, 1998.
  - *Maja Stevanov*, Second prize, 1998.
  - *Marijana Kirćan*, First prize, 2002.
  - *Saša Korom*, Third prize, 2002.
  - *Dragan Nikolić*, Extraordinary Pupin's Prize on the occasion of the 150th birth anniversary of Mihajlo Pupin, 2004.
- ***The Dr Zoran Đinđić Prize***, which is awarded annually by the Executive Council of Vojvodina to the best young scientists and researchers from the territory of the Province, obtained by:
  - *Dr Ivana Ivančev-Tumbas*, Department of Chemistry, Biochemistry and Environmental Protection, as the best young researcher in the area of natural sciences in AP Vojvodina, 2004;
  - *Dr Igor Dolinka*, Department of Mathematics and Informatics, as the best young scientist and researcher in AP Vojvodina, 2006;
  - *Dr Miloš Stojaković*, Department of Mathematics and Informatics, as the best young scientist and researcher in Vojvodina, 2008;
  - *Dušan Mrđa, PhD*, Department of Physics, as the best young scientist and researcher in Vojvodina, 2009.
- ***The Mileva Marić-Einstein Award*** to the best students of mathematics obtained in:
  1994/95. *Nataša Krejić* – PhD thesis
  1996/97. *Miroslav Treml* – scientific contribution

Katarina Jegdić – extraordinary results
Zorana Lužanin – PhD thesis

1997/98. *Miroslav Treml* – scientific contribution
Aleksandar Popović – BSc final paper
Mihal Bađonski – MSc thesis

1998/99. *Viktor Kunčak* – extraordinary results
Aleksandar Takači – BSc final paper
Đorđe Herceg – PhD thesis

1999/00. *Boris Šobot* – the best student
Viktor Kunčak – the best student
Dora Seleši – seminar paper
Igor Dolinka – PhD thesis

2000/01. *Nebojša Mudrinski* – seminar paper

2001/02. *Andrea Hajdu* – BSc final paper
Aleksandar Pavlović – MSc thesis
Danijela Rajter-Ćirić – PhD thesis

2002/03. *Vladimir Kostić* – extraordinary results in studies
Tijana Drljević – BSc final paper
Helena Zarin – PhD thesis

2003/04. *Maja Tasković* – achieved results
Kosa Nenadić – BSc final paper
mr Boris Šobot – MSc thesis

2004/05. *Danijela Boberić* – extraordinary results in studies
Srđan Škrbić – MSc thesis

2005/06. *Maja Tasković* – BSc final paper

- ***The Aleksandar Saša Popović Award***, which bears the name of the talented young scientist, teaching assistant of the Faculty of Sciences, Aleksandar Saša Popović, who, as a reservist of the Yugoslav Army was killed in the NATO bombing of Yugoslavia on June 1, 1999; it is awarded to BSc students of informatics for *extraordinary success achieved in study and in completing their BSc final paper.* The award was won by:
  1998/99. *Dragoslav Pešović*
  1999/00. *Vladimir Kurbalija*
  2002/03. *Ivan Pribela*
  2004/05. *Bojana Dimić*
  2005/06. *Marko Ovuka*
  2006/07. *Mirjana Rakić*
  2007/08. *Danica Porobić*

- ***The Aleksandar Saša Popović Award*** *for extraordinary scientific work in the area of computer sciences for young researchers* was obtained by:
  2001. *Viktor Kunčak*
  2002. *Dragoslav Pešović*
  2003. *Vladimir Kurbalija*
  2006. *Ivan Pribela*
  2007. *Živana Komlenov*
  2008. *Doni Pracner i Nenad Tomašev*
  2010. *Slobodan Mitrović*
  2011. *Miloš Savić*

- The award in the competition ***The Best Technological Innovation (BTI)*** The competition for BTI is traditionally organized under the auspices of

BUILDINGS

Teaching and research work takes place in 65 teaching rooms and 73 laboratories of a total area of 22,308 square metres. Very well-equipped research and teaching laboratories make the basis for the scientific activities of the Faculty, which are realized within national and international projects. A priority is given to the improvement of working conditions and the renewal of the equipment. Every department has its own library with tens of thousands of books and several hundreds of journals.

JOURNALS ISSUED BY THE FACULTY OF SCIENCES

- ***Zbornik radova Prirodno-matematičkog fakulteta – Serija za biologiju***, (*Proceedings of the Faculty of Sciences – Biology Series*), Department of Biology and Ecology, Editor-in-Chief : Prof. Ružica Igić.
- ***Journal of Research in Physics***, Department of Physics, Editor-in-Chief Prof. Ištvan Bikit.
- ***Geographica Pannonica***
  Department of Geography, Tourism and Hospitality Management, Editor-in-Chief Prof. Lazar Lazić.
  Gea, Department of Geography, Tourism and Hospitality Management and Geographical Society of Vojvodina, Editor-in-Chief Prof. Lazar Lazić.
  Zbornik radova Departmana za geografiju, turizam i hotelijerstvo (*Proceedings of the Department of Geography, Tourism and Hotel Management*), Editor-in-Chief: Prof. Branko Ristanović.
  International Scientific Journal – Turizam, Department of Geography, Tourism and Hospitality Management, Editor-in-Chief Prof. Vladimir Stojanović.
- ***Kvalitet voda***, (*Water Quality*), Department of Chemistry, Biochemistry and Environmental Protection, Editor-in-Chief Prof. Božo Dalmacija.
- ***Novi Sad Journal of Mathematics***, Department of Mathematics and Informatics, Editor-in-Chief Prof. Dragoslav Herceg.

the Ministry of Science and Technological Development of the Republic of Serbia. At the BTI competition in 2008, the students' team MAGNETO from the Faculty of Sciences won the third place in the competition of 180 teams. The team members were:
- *Miloš Todorov*, senior undergraduate of Mathematics,
- *Smiljka Todorov*, senior undergraduate of Physics,
- *Marijana Markov*, senior undergraduate of Mathematics.

- ***The Kostić Fund*** for chemical sciences awarded:
  - *Aleksandar Korom* (2002),
  - *Zsigmond Papp* (2007),
  - *Sanja Dožić* (2008) and
  - *Sanja Kler* (2009).

- ***The FameLab – Laboratory of the Famous, competition of science communicators***
  The FameLab is an international science communication competition created to discover new personalities in science (aged 18-35) who will know how to develop their ideas and skills and present them to the television audience. In 2008, all the competitors of the final in Serbia were from the Faculty of Sciences. PhD *Tijana Prodanović*, assistant professor of the Department of Physics won the first place in Serbia, and the second and the third places were won by *Vanja Marijanski* (student of the second year of Biochemistry at the Department of Chemistry, Biochemistry and Environmental Protection) and *Ivana Horvat*, senior undergraduate of Astronomy at the Department of Physics. At the International FameLab competition held last year in Cheltenham (Great Britain), *Tijana Prodanović* from the Department of Physics won the fantastic second place. *Mariana Joškov* from the Department of Physics was the best in Serbia, 2011.

- ***CheckMark Foundation Awards***
  In 2010 *Igor Šimanji* was awarded for the best Master's thesis, *Anka Džigurski*, a MSc candidate in Biochemistry was awarded for the best BSc final paper, whereas the third place was awarded to *Marija Savić*, a MSc candidate in Molecular Biology.

- ***October Award***
  Svetlana Lukić Petrović, PhD, 2010

- ***Life Achievement Award***
  Slobodan Glumac, PhD, 1996, *Academician Bogoljub Stanković*, 1998, *Bratislav Tošić*, PhD, 2000, *Jovan Petrović*, PhD, 2001, *Nebojša Carić*, PhD, 2003, *Academician Mileva Prvanović*, 2004, *Živko Stanković*, PhD, 2005, *Desanka Marić*, PhD, 2006, *Dušan Surla*, PhD, 2007, *Ištvan Žigrai*, PhD, 2008, *Mario Škrinjar*, PhD, 2009, *Ljiljana Vapa*, PhD, 2010, *Vukadin Leovac*, PhD, 2011

SCIENTIFIC RESEARCH PROJECTS

Currently, there are twenty seven international projects in the process of realization (FP7, Hungary-Serbia IPA Cross border Co-operation Programme, South East Europe Programme, CEEPUS, SEE-ERA.NET, COST action, SCOPES, bilateral cooperation and multilateral cooperation) and 71 projects

of the Ministry of Education and Science of the Republic of Serbia in the group of fundamental research, technological development and integral and interdisciplinary research, 27 of them being led by researchers from the Faculty of Sciences. The Provincial Secretariat for Science and Technological Development is financing work on another 27 projects.

There are continual activities on the preparation of proposals for projects in the frame of international cooperation. These projects are aimed at strengthening the research infrastructure, expanding professional scientific and educational capacities of the Faculty, and integration into the research space of Europe and the world.

STUDENTS' SCIENTIFIC RESEARCH SOCIETIES

Students of the Faculty of Sciences have their organizations and societies whose activities are financially, technically and professionally supported by the Faculty. The presently active societies and organizations are:

- Astronomical Society "Novi Sad" – ADNOS,
- Society of Young Researchers of the Department of Geography, Tourism and Hotel Management "Branislav Bukurov",
- Scientific Research Society of Biology Students "Josif Pančić",
- European Geography Association of Students and Young Geographers, EGEA – Novi Sad Section.

Astronomical Society "Novi Sad" – ADNOS, a scientific base of the study of astronomy and astrophysics at the Department of Physics has been active since 1973. The Society is continuing the tradition of the Astronomical Section, founded in 1954. The Novi Sad Observatory and Planetarium are situated on the Petrovaradin Fortress.

Society of Young Researchers of the Institute of Geography "Branislav Bukurov" was founded in 1992, and it proudly bears the name of the Academician Branislav Bukurov, the founder of geography as educational and scientific discipline and the founder of the Institute of Geography (presently Department of Geography, Tourism and Hotel Management).

The main activities of the Society are education of Faculty students and high-school students, and their initiation in scientific research. They organize the annual research, educational and volunteering field works (camps) within different projects, led mainly by students.

The Society organizes educational camps and lectures about the contemporary issues in the fields of geography, tourism, and ecology, as well as lectures of travelogue type.

The aims and tasks of the Society are:

- To organize young people and animate them for engagement in scientific research;
- Work with talented students and school children to initiate them to do individual research;
- Organization of publishing activities for the needs of the Society and further;
- Presentation of research results of the young members in the fields of geography and tourism to the domestic and international community.

The European Geography Association of students and young geographers, EGEA – the Novi Sad Section, was founded in 1987 on the initiative of students of geosciences from the universities of Barcelona, Utrecht,

DOCTORAL DISSERTATIONS, MASTER'S THESES AND SPECIALIST PAPERS

By October, 2011, 540 PhD theses, 654 MSc (magister) theses, 603 master's papers and 172 specialist papers were defended at the Faculty, namely:

PhD Theses:
- Biology and Ecology, 125
- Physics, 56
- Geography, Tourism and Hotel Management, 95
- Chemistry, 124
- Mathematics and Informatics, 136

MSc (magister) Theses:
- Biology and Ecology, 149
- Physics, 14
- Geography, Tourism and Hotel Management, 105
- Chemistry, 171
- Mathematics and Informatics, 215

Specialist Papers:
- Biology and Ecology, 23
- Physics, 2
- Geography, Tourism and Hotel Management, 40
- Chemistry, 42
- Mathematics and Informatics, 64

Master's Theses
- Biology and Ecology, 196
- Physics, 38
- Geography, Tourism and Hotel Management, 106
- Chemistry, 130
- Mathematics and Informatics, 118

LIBRARIES

Each of the Departments of the Faculty of Sciences possesses its own library. The library collections and services, provided by qualified librarians with the necessary IT knowledge, contribute significantly to the advancement of teaching and scientific research at the Faculty. The Faculty libraries personnel includes seven librarians (of which two have MSc degrees and one is a senior librarian) and three library technicians.

Special advancement in the library work and providing services has been realized by automating the work and forming electronic catalogues, which enhanced efficiency of handling library information, and modernized and facilitated search of library funds. Also, the librarians are trained to search through the catalogues of other libraries, including also electronic repositories, enabling the users to benefit from the access to a great number of publications and valuable stocks of information.

How to find us?

The Faculty of Sciences is located in the Campus of the University of Novi Sad, Trg Dositeja Obradovica 2-4, Novi Sad

Warsaw and Vienna. Presently, the EGEA encompasses students from more than 80 universities from 30 countries. The main idea is to allow students to expand their horizons, get acquainted with new people, cultures, customs, etc.

The main EGEA activity is the organization of annual congresses in September or October, which last for 6 or 7 days. The congresses consist of workshops for discussing contemporary issues, professional excursions and presentations.

The Scientific Research Society of Students of Biology "Josif Pančić" of the Department of Biology and Ecology was founded in 1973, based on the long-standing activities of the students and teaching staff of the Institute of Biology of that time. It gathers all the students of biology and ecology and combined studies who are interested in doing research, advancement and protection of the environment or in education in these areas. Within the Society, the students have the opportunity to get a deeper insight into the principles and methods of research, to participate actively in research activities and to realize their own ideas and present results at the students' and other meetings, satisfying thus their needs and interests that are not presented in much detail in the course of regular studies.

Every year, the SRSSB "Josif Pančić" organizes several scientific research camps. The participation in these camps gives the students opportunity to get necessary experience in doing field work and research and acquire practical knowledge in the areas of their own interest.

CONTACTS IN THE DEAN'S OFFICE

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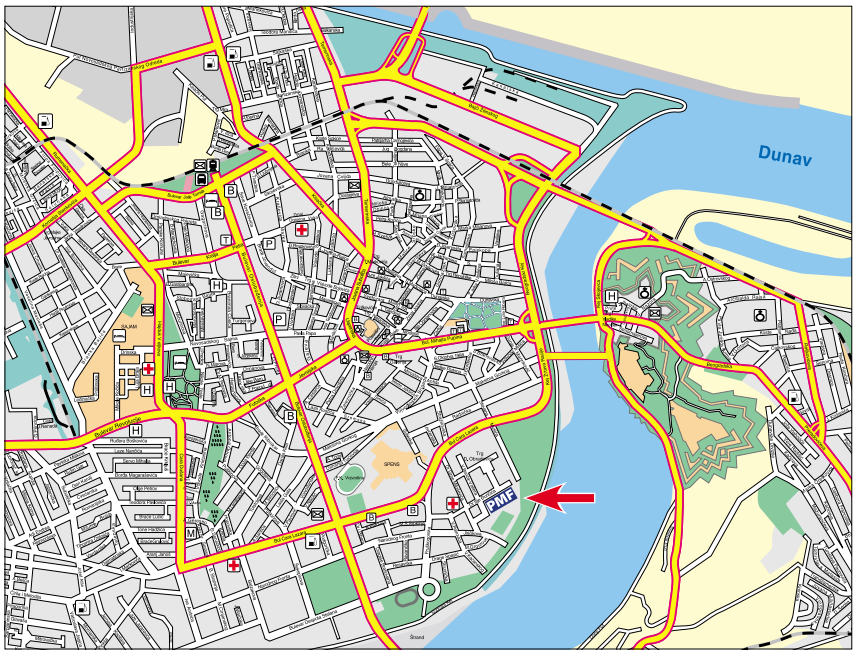

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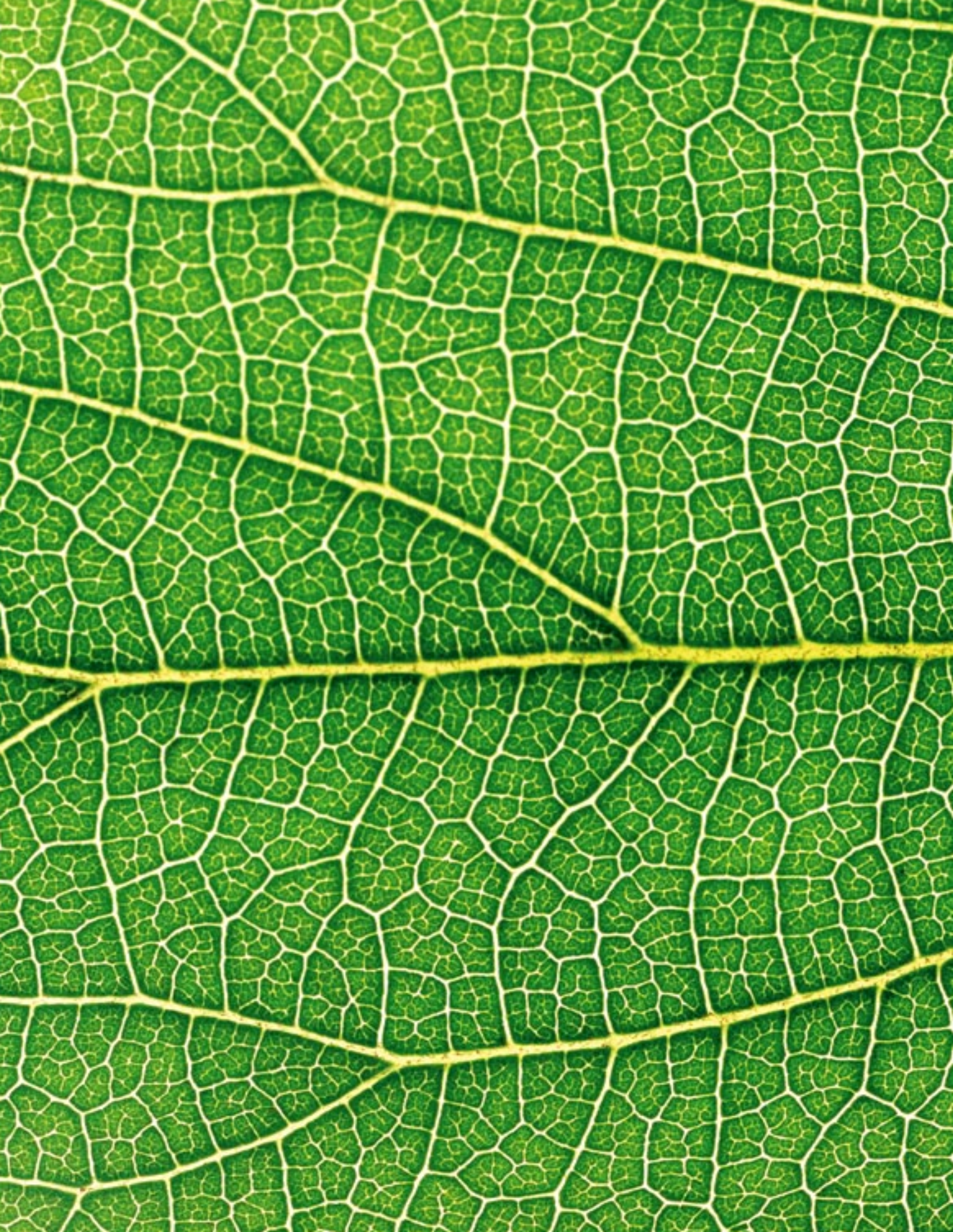
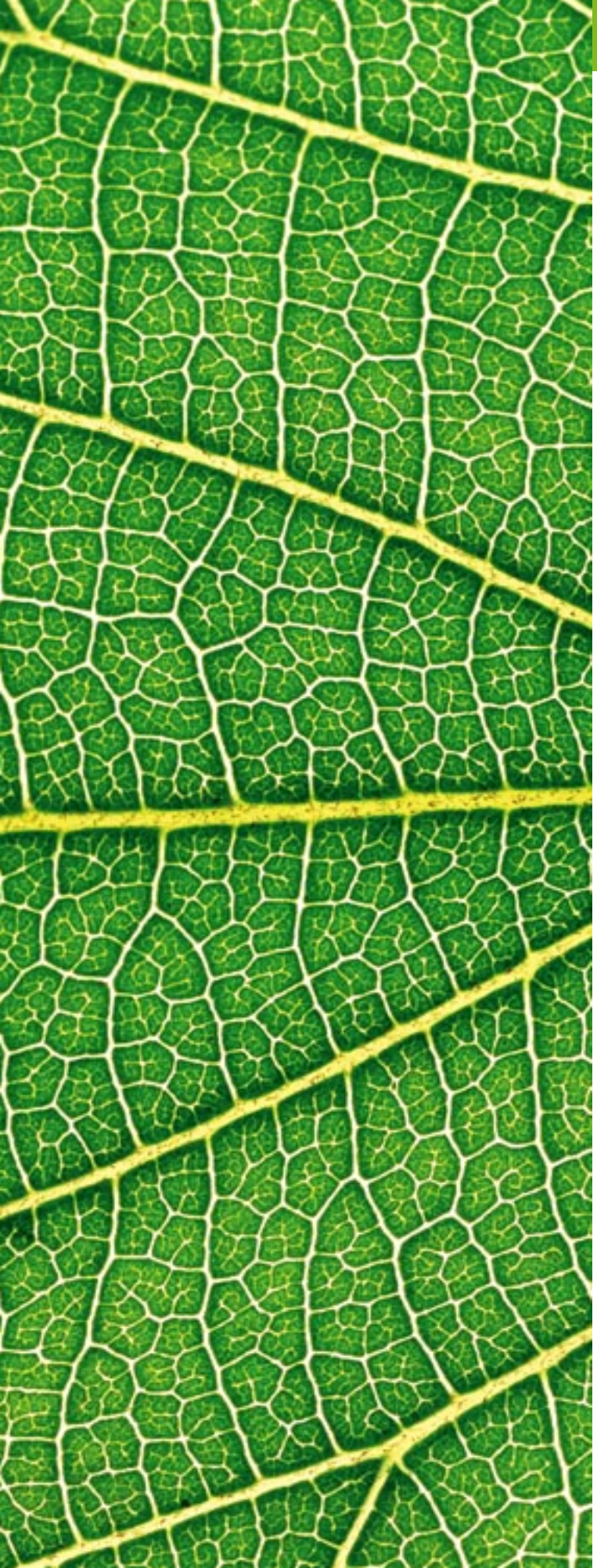
An extremely important source of scientific information is the KoBSON – the Consortium of Libraries of Serbia for coordinated acquisition (http://kobson.nb.rs/Kobson/page/), which enables access to a vast number of electronic databases, books and journals through the academic network. Via the KoBSON service, the libraries have access to full-text journals, which is of indispensable importance to all those involved in doing scientific research.

Automation of the library work started in 1996 by implementing the Library Software System BISIS Ver. 1.0. The BISIS system has constantly been in the process of development at our Faculty, and presently is operative in its Ver. 4.0. Through the local academic network, this system is connected to the Academic Network and Internet. The BISIS system supports treatment of library documents in the UNIMARC format, which enables access to library records via the Net and their exchange with other libraries.





Department of **Biology and Ecology**

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LABORATORY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY

Members of the Research Group

- Dr Gordana Grubor-Lajšić, full professor
- Danijela Kojić, MS, teaching assistant
- Jelena Purać, MS, teaching assistant
- Željko Popović, junior researcher
- Elvira Pamer, junior researcher
- Ana Blanuša, technician

Contact Person

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Equipment

In addition to the basic laboratory equipment, the Laboratory is equipped with complete instrumentation for various types of electrophoresis: vertical and horizontal electrophoresis on polyacrylamide and agarose gels, isoelectric focusing, Western blot, immunoelectrophoresis.

The Group's research is focused on biochemical and molecular mechanisms of insects' resistance to low temperatures, using European corn borer (*Ostrinia nubilalis*) and Arctic springtail (*Onychiurus arcticus*) as model organisms. *O. nubilalis* is a diapausing species that enters diapause at the larval stage and is capable of surviving freezing of body fluids. On the other hand, due to its inability to survive freezing of the body fluids, *O. arcticus* has a completely different strategy of surviving severe polar winters. Namely, during cryoprotective dehydration, this wingless insect gradually loses body water up to 90 percent and enters the state without water, the so-called *anhydrobiosis*.

Dehydration and resistance to low temperatures are studied from the aspect of the synthesis of specific molecules (carbohydrates, amino acids, lipids, proteins), as well as regulation of metabolic pathways (including redox signaling), which are at the basis of the insects adaptation to low temperatures.

The Laboratory is also concerned with the study of the antioxidative defense system in various organisms/systems as well as with the effects of alumionosilicate supplement to animal diets.

Part of the research group of the Laboratory for Biochemistry and Molecular Biology in the Arctic (Ny Alesund) within the FP6 project

Members of the Laboratory for Biochemistry and Molecular Biology

PARTICIPATION IN PROJECTS

- **Sleeping beauty, Dormancy of cells and organisms-strategies for survival and preservation, The Sixth Framework Programme of European Union (FP6); Project No.: FP6-2003-NEST-B-1, 2005-2008.** Laboratory Coordinator: Prof. Gordana Grubor-Lajšić, Faculty of Sciences, Novi Sad. The Laboratory members were engaged in the project within the research group of the British Antarctic Survey (BAS), Cambridge, UK.
  The aim of the project was to characterize different kinds of dormancy (state of hypo- or ametabolism) on physiological, biochemical and molecular levels, which would enable their potential application in biotechnology, medicine, and ecology. In the frame of this multidisciplinary project use was made of five model organisms belonging to different taxonomic groups, dormancy state of which was studied using modern techniques of gene expression, proteomics, and analysis of metabolites.
- **The role of active redox substances in homeostatic processes, the Ministry of Science and Technological Development of the Republic of Serbia, Fundamental research, Project No. 143034, 2005 – 2010.** Project Leader: Dr Duško Blagojević, Institute of Biological Research "Siniša Stanković", Belgrade.
  Maintenance of homeostasis, as the harmonization of numerous biochemical reactions and physico-chemical processes in living systems under variable environmental conditions, is a main prerequisite of life. In such conditions, the survival is guaranteed only due to the timely response to the current requirements of the environment. Living beings have developed a number of regulatory mechanisms that enable them normal functioning in a wide span of environmental conditions.
  The investigations within this project are also concerned with the study and analysis of the antioxidative protection system and its regulatory role in different systems (insects, cell cultures). Part of the project in which this group is involved is concerned with the study of biochemical and eco-physiological bases of adaptation of insects to low temperatures, especially from the aspect of studying particular specific proteins and cryo/anhydro protectors.

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LABORATORY FOR REPRODUCTIVE ENDOCRINOLOGY AND SIGNALING (RES)

Research activities of the RES group take place in several areas: cell signaling, reproductive endocrinology, immobilization stress. Current investigations are concerned with some aspects of mechanisms and signaling pathways that are included in the adaptation of the disturbed steroidogenesis of Leydig cells to repeated immobilization stress; Role of cAMP/cGMP signaling and some GPCRs in the stress-disturbed steroidogenesis of Leydig cells; cAMP/cGMP "cross-talk" in the regulation of steroidogenesis of Leydig cells; cAMP/cGMP signaling in Leydig cells of hypogonadal rats and the effect of testosterone treatment on cAMP/cGMP signaling in Leydig cells; Effect of the application of Viagra on steroidogenesis and cAMP/cGMP signaling in Leydig cells.

EXPERTISE OF THE RES GROUP

- Breeding and treatment of laboratory animals including various surgical techniques, as well as different ways of administering/applying drugs and biologically active substances.
- Cell cultures and tissues: preparation and culturing of different types of primary and immortalized cell lines, as well as primary tissue cultures.
- Molecular biology techniques: 1) Basic manipulations of RNA/DNA. 2) Transgenic Technology. 3) siRNA and Functional Genomics. 4) Molecular Diagnostic of Hepatitis C Virus, Human Papilloma Virus, Chlamydia Trachomatis. 5) Molecular Biology Software.
- Methods of static and kinetic analyses of secretion of hormones and secondary messengers, as well as their detection by radioimmunological analyses (cAMP, cGMP, PRL, FSH, LH, GH, GnRH, steroid hormones), RRA (Scatchard, Competitive analysis), ELISA, Protein assays, Nitrite assay, etc.
- Methods of protein detection: Western-blot analysis, Immunoprecipitation.
- Methods of characterization of mitochondria (TMRE assay; MitoTrack assay).
- Methods of studying enzyme activity and kinetics.
- Various techniques of investigating agonist/antagonist activities on different *in vitro* (subcellular fractionation and enzyme activity, primary cultures of cells and tissues) and *in vivo* levels.

RUKOVOĐENJE PROJEKTIMA

- **Bilateral cooperation Serbia-Slovenia: Involvement of cGMP in the inflammatory response of chicken macrophage on Mycoplasma synoviae**
  The project is financed in the frame of the current program of the Ministry of Science and Technological Development of the Republic of Serbia.

Members of the Research Group

- Dr Tatjana Kostić, full professor
- Dr Silvana Andrić, associate professor
- Nataša Stojkov, junior researcher, PhD student of biochemistry
- Mariija Janjić, junior researcher, PhD student of biochemistry
- Andrea Majoroš, junior researcher, PhD student of molecular biology
- Marica Jović, laboratory technician

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Cooperation

- Dr Stanko Stojilkovic, SCS, Program for Developmental Neurosciences, NICHD, NIH (Bethesda-MD, USA)
- Dr Mojca Narat, Biotechnical Faculty at University of Ljubljana (Ljubljana, Slovenia)

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2. Andric SA, Janjic MM, Stojkov NJ & Kostic TS (2007): Protein kinase G – mediated stimulation of basal Leydig cell steroidogenesis. Am J Physiol Endocrinol Metab 293 (5): E1399-1408.
3. Andric SA, Kostic TS & Stojilkovic SS (2006): Contribution of multidrug resistance protein - MRP5 in control of cGMP intracellular signaling in anterior pituitary cells. Endocrinology 147 (7): 3435-3445.

Project Leader: Prof. Tatjana Kostić, Faculty of Sciences, Novi Sad.
Partner on the project: Biotechnical Faculty, University of Ljubljana (Ljubljana, Slovenia); Leader: Dr Mojca Narat.
The objective: to study the role of cGMP in the initiation of immune response of chicken macrophage to the infection with Mycoplasma synoviae. It is expected that the results should demonstrate the importance of the so-called "cross-talk" communication between the cGMP signaling and other signal pathways in the synchronization of the macrophage function in the inflammatory immune response and its prevention/therapy.

- **NO-cGMP dependent mechanisms in regulation of steroidogenesis of Leydig cells (ON143055)**
  The project is co-financed within the current program of fundamental research of the Ministry of Science and Technological Development of the Republic of Serbia.
  Project Leader: Prof. Tatjana Kostić, Faculty of Sciences, Novi Sad.
  The objective: to study the role of the NO-cGMP signal path in the regulation of steroidogenesis in Leydig cells and the mechanism of the action of this signal path with normal, stressed, hypogonadal/testosteron treated, and Viagra-treated rats.
  Results: defining of new regulation mechanisms of androgens production in normal and disturbed conditions of homeostasis of Leydig cells (hypogonadism, steroid-dependent cancers, as well as the other reproductive dysfunctions).
- **Molecular physiology of Leydig cells in response to stress (APV0667)**
  The project is co-funded by the Provincial Secretariat for Science and Technological Development of the AP Vojvodina.
  Project Leader: Prof. Silvana Andrić, Faculty of Sciences, Novi Sad.
  The objective: to study the cAMP/cGMP signal paths of "cross-talk" communication as the possible mechanism of adaptation capable of contributing to a better recovery of the steroidogenesis of Leydig cells in the course of repeated immobilization stress. The results demonstrated the importance of the "cross-talk" communication between cAMP and cGMP signaling, as well as of mitochondrial dynamics and stereogenesis in the synchronization of the function of Leydig cells and development of an adaptive response. Final results should help the understanding of the molecular physiology of Leydig cells in the stress response of the organism as a whole.

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LECOTOX

Members of the Research Group

- Dr Radmila Kovačević, full professor, Head of the Laboratory
- Dr Ivana Teodorović, associate professor
- Sonja Kaišarević, MS, teaching assistant
- Kristina Pogrmić, PhD student, junior researcher
- Svetlana Fa, PhD student, junior researcher
- Vanja Dakić, PhD student, junior researcher
- Ivana Planojević, PhD student, junior researcher

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LABORATORY FOR ECOTOXICOLOGY

Laboratory for Ecotoxicology (LECOTOX) of the Department of Biology and Ecology of the Faculty of Sciences in Novi Sad began officially its work in 2006. Its aim is to establish a multidisciplinary team whose research interest would be directed to assessing toxicity of various substances and elucidating the mechanisms of their toxic action using new experimental methods based on gene expression, along with conventional toxicity tests and bioanalyses. In the frame of LECOTOX there are two main research directions: a) Xenobiotics with hormonal activity/reproductive toxicology, and b) Aquatic toxicology – identification and characterization of toxicity in accordance with the currently valid scientific approach and standards of the quality of the environment.

The Laboratory employs the following methods based on the analysis of molecular and cellular biomarkers: Induction of CYP enzyme (microEROD analysis); Tests of viability cytotoxicity/proliferation; Gene-expression analyses RTqPCR; ELISA or RIA for steroidal hormones and other biomolecules; Tests for establishing estrogenic effects and study of oxidative stress and effects of early intoxication – antioxidative enzymes; Lipid peroxidation.

The battery of acute and chronic toxicology tests on standard test species includes: *Daphnia magna, Danio rerio, Selenastrum capricornutum, Vibrio fischeri, Pseudomonas putida* according to ISO/CEN, OECD and US EPA standard methods for testing toxicity of pure substances and complex mixtures; tests of ambiental toxicity and whole effluent toxicity (WET) of water for the purpose of monitoring in accordance with the current legislation, but also the tests of toxic contaminated sediment and soils for the needs of study-

Instructing how to use the instrument for quantitative gene expression analysis

Work in the lab for cell cultures

ing feasibility of proposed remediation programs and risk assessment. LECOTOX is capable of performing aquatic tests for the needs of establishing standards of the quality of the environment (according to the Annex V of Water Framework Directive) and provide expertise to the pertinent organs and industry in the case of exploration monitoring. All LECOTOX activities are carried out in accordance with the principles of good laboratory practice (GLP), observing ethical standards.

LEADING OF PROJECTS

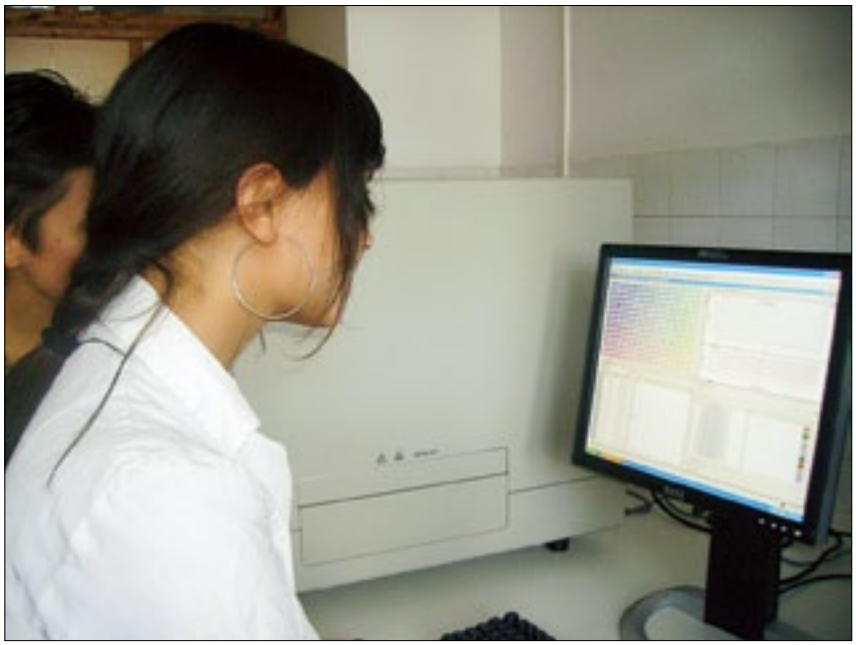
- **Reinforcement of Research Potential of the Laboratory for Ecotoxicology (Rep-Lecotox)**
  Contract No.: INCO-CT-2006-043559-REP-LECOTOX, financed by the European Commission within The Sixth Framework Programme (FP6) of the European Union.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad
  Period: January 2007 – December 2009.
  The objective of the REP LECOTOX is the cooperation with EU research centers, scientific exchange and training of young researchers, employment of the young, renewal of the existing and acquiring modern laboratory equipment. By realizing these goals, LECOTOX will become prepared to face new challenges in the area of ecotoxicology: ecotoxicogenomics – study of gene and protein expression as the most early response to the exposure to toxic substances in the environment. Rapid development of the methods based on gene expression and their application in elucidating hot ecotoxicological problems such as the mechanism of toxic action, but also very intensive international cooperation and exchange of information in this area – all these issues indicate the importance of the topic and justify the decision of LECOTOX to direct permanently its activities in this direction. The realization of the project should ensure better integration of the LECOTOX in the European research area

Cooperation

- Department of Effect-Directed Analysis and Department of Bioanalytical Ecotoxicology, Helmholtz Centre for Environmental Research (UFZ), Leipzig, Germany,
- Molecular Pathobiology - Cell Toxicology, School of Biosciences, University of Birmingham, Birmingham, UK,
- RECETOX, Masaryk University, Brno, Czech Republic,
- CECRA, Department of Chemistry, Faculty of Sciences, University of Novi Sad

Equipment

- 7900HT Fast Real - Time PCR System with TaqMan Low Density Array Block; Veriti Thermal Cycler, 96-Well; BioFix Lumi Fix 10 (Vibrio fischeri toxicity tests) and freezer -70; FP6 project REP LECOTOX, Br. 043559.
- Laminar (HPH 12 Heraguard–Kendro) and CO_2 incubator (POLY TEMP SCI) for cell cultures - WUS-CEP, Austria, Grant No. 121/2002
- Fluoroskan Ascent and Multiscan Plate reader (Thermo–Labsystems); FP5 project APOPSBAL Grant No. 2 – CT2002 – 10007
- Wallac 1410-scintillation counter, Project IAEA, Year: 1990.



Instructing how to use the instrument for quantitative gene expression analysis

(ERA), and make this research team an adequate partner in the future projects in the area of fundamental and applied research within the FP and other programs.
First REP LECOTOX workshop, June 2008, Ecotoxicogenomics: Challenge of including genomics/proteomics/metabolics in aquatic and terrestrial ecotoxicology.

RQ-PCR system for quantitative gene expression analysis, purchased in 2007 from the resources of the FP6 REP-LECOTOX project

Work in the lab for cell cultures

- **Xenobiotics with hormone activity – effects on reproductive function and thyroid gland function, and the identification of their presence in bioassays**
  Project No.: 143058; Program of Fundamental Research, the Ministry of Science and Technological Development of the Republic of Serbia.
  Project Leader: Prof. Radmila Kovačević
  Participants in the project: Faculty of Sciences and Faculty of Technical Sciences, Novi Sad
  Period: January 2006 – December 2010.
  The project objectives: (a) investigation of the influence of some brominated burning inhibitors, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and pesticides on the testicular function of the thyroid gland by studying expression of the genes responsible for testicular steroidogenesis, activity of enzymes involved in steroidogenesis, structure and ultrastructure of the thyroid gland and use of some other biomarkers; (b) Assessment of the presence of xenobiotics in the different types of environmental samples by applying biomarkers, conventional toxicity tests, and chemical characterization.
  The expected results are: (a) Closer definition of the mechanisms of potential negative action of selected substances; (b) Development of the methodology of identification and overall assessment of the state of the environment, with the emphasis on potential ecotoxicity using alternative approach, where the results of bioanalysis govern detailed chemical analysis and characterization of the samples.

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HISTOLOGY AND EMBRYOLOGY

Laboratory for Histology and Embryology at the Department of Biology and Ecology of the Faculty of Sciences was founded in 1992 as the education-research basis for teaching Histology with Embryology, the subject that had been previously taught to students of Biology under auspices of the Faculty of Medicine. The scientific research of the Laboratory is concerned with the area of experimental endocrinology, especially with study of the effects of various stressors (cold, alcohol, electromagnetic radiation) on structural characteristics of endocrine glands (pituitary gland, pineal gland, thyroid gland, adrenal gland, and endocrine pancreas), as well as cytotoxic effects of different environmental contaminants on the liver of amphibians.

The Laboratory for Histology and Embryology has at its disposal the equipment for treatment of tissue samples and their routine and immunohistochemical staining (rotational microtome, ultramicrotome and other accompanying standard equipment needed for the work in a histological laboratory).

LEADING OF PROJECTS

- **Monitoring of the status of the thyroid gland in the treatment of postmenopausal experimental osteoporosis**
  Project No.: 114-451-01426. The Provincial Secretariat for Science and Technological Development, 2006-2007.
  Project Leader: Prof. Milica Matavulj, Faculty of Sciences, Novi Sad.
  The project was carried out in the cooperation with the Institute of Physical Medicine, Rehabilitation and Balneo-Climatology "Mlječanica", Kozarska Dubica, Republic of Srpska.
- **Monitoring of the status of the thyroid gland in the treatment of postmenopausal experimental osteoporosis**
  Project No.: 114-451-00637. The Provincial Secretariat for Science and Technological Development, 2007-2008.
  Project Leader: Prof. Milica Matavulj, Faculty of Sciences, Novi Sad.
  The project was carried out in the cooperation with the Institute of Physical Medicine, Rehabilitation and Balneo-Climatology "Mlječanica", Kozarska Dubica, Republic of Srpska.
- **The effect of extremely low-frequency electromagnetic field on the structure of endocrine glands and skin**
  Project No: 153001. Ministry of Science and Technological Development of the Republic of Serbia, 2008-2010.
  Project Leader: Prof. Milica Matavulj, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Ecological investigations of aquatic ecosystems (the Canal Danube-Tisa-Danube) aimed at a rational utilization and sustainable development of the resources**
  Project No.: OSI147. Federal Ministry of Science of Federal Republic of Yugoslavia, 1994-2000.

Members of the Research Group

- Dr Milica Matavulj, full professor
- Dr Vesna Rajković, assistant professor
- Zorana Banovački, MS, teaching assistant
- Ivana Koledin, PhD student
- Renata Kovač, junior researcher
- Maja Oberman, laboratory technician

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Cooperation

The Research group of the Laboratory for Histology and Embryology cooperates with a number of similar institutions, and among them are: Department of Neurosciences, Karolinska Institute, Stockholm; Institute of Physical Medicine, Rehabilitation and Balneo-Climatology "Mlječanica", Kozarska Dubica; Institute of Pathology and Histology, Faculty of Medicine, Novi Sad; Faculty of Biology, Belgrade; Faculty of Science, Department of Biology, Banja Luka; and Pathological Laboratory, Faculty of Medicine, Banja Luka, Republic of Srpska.

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In the histological laboratory

Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.

- **Study of morphofunctional characteristics of organisms under conditions of the influence of different physical and chemical factors**
  Project No: 1334; Ministry of Science and Environmental Protection, 2002-2005.
  Project Leader: Prof. Bogosav Lažetić, Faculty of Medicine, Novi Sad.
- **Xenobiotics with hormonal activity – effects on reproductive function of the thyroid gland and the identification of their presence by bioanalyses**
  Project No.: 143058. Program of fundamental research of the Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad.
- **Reinforcement of Research Potential of the Laboratory for Ecotoxicology (REP-LECOTOX)**
  Project No.: INCO-CT-2006-043559-REP-LECOTOX, financed by the European Commission within the Sixth Framework Programme (FP6) of the European Union.
  Period: January 2007 – December 2009.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad.
- **Course Development Plus Program (CDP+ project) - Course: Endocrinology (No. 043/2004)**
  Federal Ministry of Foreign Affairs of Austria, 2004-2005.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad.

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6. Rajković V., Matavulj M., Gledić D., Lažetić B. 2003. Evaluation of rat thyroid gland morphophysiological status after three months exposure to 50 Hz electromagnetic field. *Tissue and Cell* 35: 223-231.
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8. Matavulj M., Rajković V., Ušćebrka G., Žikić D., Matavulj A., Lukač T., Lažetić B. 1998. Interactions of thyroid gland with non-ionizing electromagnetic fields. In: B. Lažetić and K.V. Sudakov (eds.) *Basic and Clinical Aspects of the Theory of Functional Systems*, University of Novi Sad, Medical Faculty and P.K. Anokhin Institute of Normal Physiology, RAM Moscow, Novi Sad, pp. 199-206.
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LABORATORY FOR GENETICS

Research activity of the Group is focused on studies of genetic biodiversity of plant and animal genomes using molecular markers, application of molecular markers in conservation genetics of natural game population, and application of protein and molecular markers in crossbreeding of wheat and barley. The work is carried out in the Genetics Laboratory, where there exists all the basic equipment needed for molecular genetic investigations.

LEADING OF PROJECTS

- **WUS Austria – Serbia, project: Diversity of plant and animal genomes – perspectives in breeding and conservation biology**
  C.E.P. 7949-00/02 CEP No. 099/2003 2003-2004.
  Project Leader: Prof. Ljiljana Vapa, Faculty of Sciences, Novi Sad.
- **Evaluation of genetic biodiversity of wheat germplasm using molecular markers**
  Ministry of Science and Environmental Protection of the Republic of Serbia
  Project No.: IO 1773
  Project Duration: 2001-2005
  Project Leader: Prof. Ljiljana Vapa, Faculty of Sciences, Novi Sad.
- **Genotoxic effects of war action on plant genomes**
  City Administration, Secretariat for Urbanism, Housing and Environmental Protection, Novi Sad.
  Project Duration: 1999-2001.
  Project Leader: Prof. Ljiljana Vapa, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Reinforcement of Research Potential of the Laboratory for Ecotoxicology (REP-LECOTOX)**
  Project No.: INCO-CT-2006-043559-REP-LECOTOX, financed by the European Commission in the Sixth Framework Programme (FP6) of the European Union.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad.
- **Higher Education Reform of Biological Sciences H.E.R.B.S, TEMPUS**
  Project No.: JEP400942005.
  Project Duration: 2006 - 2009
  Project Coordinator: Prof. Gordana Cvijić, Faculty of Biology, Belgrade.
- **Nitric oxide/cyclic guanosine monophosphate dependent mechanisms in the regulation of steroidogenesis of Leydig cells**
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project No.: 143055.
  Project Duration: 2006 – 2010.
  Project Leader: Prof. Tatjana Kostić, Faculty of Sciences, Novi Sad.

Members of the Research Group

- Dr Ljiljana Vapa, full professor
- Dr Dragana Obreht, assistant professor
- Dr Mihajla Djan, assistant professor
- Nevena Veličković, PhD student, junior researcher
- Nataša Kočiš Tubić, PhD student, junior researcher
- Maja Oberman, laboratory technician

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Cooperation

- Institute for Zoo Biology and Wildlife Research, Berlin, Germany
- Research Institute for Wildlife Ecology, Vienna, Austria
- Cold Spring Harbor Laboratory, New York, USA
- Institute of Field Crops and Vegetables, Novi Sad

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2. Fickel J, Hauffe HC, Pecchioli E, Soriguer R, Vapa Lj, Pitra C. Cladogenesis of the European brown hare (*Lepus europaeus* Pallas, 1778) *Eur J Wildl Res*, 2008, Vol. 54 br.3, 495-510.

- **Enhancement of genetic and productive potentials of grain crops by applying classical and modern biotechnology**
  Republic Program of Technological Development.
  Project No.: TR20138.
  Project Duration: 2008 – 2010.
  Project Leader: Dr Ankica Kondić, Institute of Field Crops and Vegetables, Novi Sad.
- **Enhancement of the quality of grain crops**
  Republic Program of Technological Development.
  Project No.: TR20139.
  Project Duration: 2008 – 2010.
  Project Leader: Dr Nikola Hristov, Institute of Field Crops and Vegetables, Novi Sad.
- **Production of special quality wheat under controlled conditions applying the HACCP principle**
  Ministry of Science and Environmental Protection of the Republic of Serbia.
  Project No.: 6849.
  Project Duration: 2005 -2008.
  Project Leader: Prof. Jasna Mastilović, Faculty of Technology, Novi Sad.
- **Enhancement of genetic production and processing potentials of wheat, barley and alternative grain crops using classical and modern biotechnology**
  Ministry of Science and Environmental Protection of the Republic of Serbia.
  Project No.: T-6880B.
  Project Duration: 2005 -2008.
  Project Leader: Dr Borislav Kobiljski, Institute of Field Crops and Vegetables, Novi Sad.

3. Vapa Lj, Djan M, Obreht D, Beuković M, Vapa M. Allozyme diversity in pheasants (*Phasianus* spp.) from breeding stations in Serbia, *Eur J Wildl Res*, 2007, Vol. 53, 52- 54.
4. Vapa Lj, Djan M, Obreht D, Hammer S, Suchentrunk F. Allozyme variability of brown hares (*Lepus europaeus*) from the Vojvodina (Serbia) compared to central and southeastern European populations, *Acta Zoologica Academiae Scientiarum Hungaricae*, 2007, Vol. 53, No. 1, 75- 87.
5. Djan M, Obreht D, Vapa Lj. Polymorphism of mtDNA regions of brown hare (*Lepus europaeus*) populations from Vojvodina (Serbia and Montenegro), *Eur J Wildl Res*, 2006, Vol. 52, No. 4, 288- 291.
6. Obreht D, Kobiljski B, Denčić S, Djan M, Vapa Lj. Potential uses of microsatellites in marker-assisted selection for improved bread-making quality in wheat, *Cereal Research Communications*, 2006, Vol. 34, No. 2-3,. 895- 902.
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LABORATORY FOR HUMAN BIOLOGY

Members of the Research Group

- Dr Verica Božić-Krstić, full professor
- Tatjana Pavlica, MS,
- teaching assistant
- Rada Rakić, MS, teaching assistant

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Cooperation

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- Faculty of Sciences, Department of Biology, Anthropology, Podgorica, Montenegro
- Faculty of Medicine, Chair of Physiology and Anthropology, Skopje, FYR Macedonia
- Faculty of Medicine, Chair of Human Biology, Chair of Anatomy, Banja Luka, Republic of Srpska
- Faculty of Sciences, Biology, Chair of Anthropology, Tuzla, Bosnia and Herzegovina
- National Academy of Science of Belarus, Anthropology, Minsk, Belarus
- University "Pajsije Hilendarski", Biology, Plovdiv, Bulgaria
- Faculty of Medicine, Chair of Human Biology, Niš
- Faculty of Medicine, Chair of Forensic Medicine, Chair of Hygiene, Chair of Anatomy, Chair of Gynecology, Novi Sad
- Faculty of Dentistry, Niš
- Faculty of Sports and Physical Education, Novi Sad

The activity of the Laboratory of Human Biology is mainly concerned with the study of anthropogenetic characteristics of the Vojvodina population. Scientific research is concerned with biometric and population genetic characteristics. In the focus of interest is human biology with the aim of gaining insight into the interaction processes of genetic factors from one hand and ecological factors to which human organism is exposed, on the other. The research is oriented in the following directions:

1. Studies of the population variability from the aspect of morphological, genetic, and physiological characteristics and influence of the ecological, primarily socio-economic and geographic factors and migration processes. They provide records of the present-day populations inhabiting primarily the area of Vojvodina.
2. In the area of growth and development of children and secondary school youths the main topics are related to quantitative characteristics, sexual maturing, and secular trends. The results have shown that there exists acceleration of the growth and development in all ontogenetic groups, and, in addition to their theoretical importance, the results are also of practical significance for medicine, psychology, pedagogy, industrial anthropology and physical education.

LEADING OF PROJECTS

- **Anthropological characteristics of Vojvodina population**
  Scientific Research Fund of Vojvodina
  Project Duration: 1987 - 1991
  Project No.: 01-1283/2
  Project Leader: Prof. Verica Božić-Krstić, Faculty of Sciences, Novi Sad.
- **Anthropological characteristics of Vojvodina population**
  Ministry of Science and Technology of the Republic of Serbia.
  Project Duration: 1992 - 1995
  Project duration: 1987 - 1991

Project No.: 2905
Project Leader: Prof. Verica Božić-Krstić, Faculty of Sciences, Novi Sad.

- **Anthropological characteristics of children and youth of Yugoslavia**
  Union of Research Funds
  Project Duration: 1987 - 1991
  Project No.: 05-26/2.
  Project Holder: Anthropological Society of Yugoslavia and the Montenegrin Academy of Science and Arts.
  Project Leader for Vojvodina: Prof. Verica Božić-Krstić, Faculty of Sciences, Novi Sad

PARTICIPATION IN PROJECTS

- **Establishment and assessment of the ecological changes of living world occurring in the new conditions on the Novi Sad territory (No. 2426)**
  Secretariat for Urbanism, Housing, and Environmental Protection, City Administration, Novi Sad.
  Project Duration: 2000 - 2002

Equipment

The Laboratory for Human Biology is equipped with original anthropological, anthroposcopic, and physiological instrumentation (Sieber-Hegner, Switzerland), as well as with the tests for population-genetic studies.

SELECTED REFERENCES

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2. Rakic, R., Bozic-Krstic, V., Pavlica, T. (2008) Age changes of body height, weight and nutritional conditions in the Novi Sad adolescents. *Acta Morphologica et Anthropologica*, 15: 2008 (in press).
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5. Božić-Krstić, V., Pavlica, T., Rakić, R. (2004) Body height and weight of children in Novi Sad. *Annals of Human Biology*, 31(3): 356-363.

LABORATORY FOR MICROBIOLOGY

The Microbiological Research Group, founded under the guidance of Prof. Olivera Ristić in the frame of the Department of Biology (later Institute of Biology), exists more than 30 years. In addition to the present ones, its members were Dr Miroslav Gantar and Dr Milutin Erbežnik, who continued their scientific careers at universities in the USA. From its foundation to the present day the main field of interest of the Laboratory has been microbiological quality of surface and ground waters. The research work is carried in several areas of environmental microbiology and protection of microorganisms, water protection - biomonitoring, sapromicrobiology and saprobiology, microbiology of drinking water and wastewaters, water toxicology, biotechnological application of microorganisms, study of bioactive agents of microorganisms, and, more recently, potential application of bacteriophage in medicine.

LEADING OF PROJECTS

- **Study of the water quality of the cross-border river Tamis as a consequence of floods**
  Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina and the Secretariat for Environmental Protection of Timis Province (Romania); University of Novi Sad and University "Vasile Goldis" from Arad, 2005-2006
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad
- **Studies in Microbiology**
  Ministry of Science and Technology of the Republic of Serbia:
  Project No.: 0335;
  Project Duration: 1991-1995
  Project Leader: Prof. Slavka Gajin, Faculty of Sciences, Novi Sad.
- **Ecological investigations of aquatic ecosystems (the Canal Danube-Tisa-Danube) aimed at the rational utilization and sustainable development of resources**
  Federal Ministry of Science, Technology and Development;
  Project No.: OSI147/1-93;
  Project Duration: 1994-2000
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Influence of Novi Sad municipal wastewaters on the quality of the Danube water as the main current and potential source of the city water supply**
  Division for Environment Protection and Advancement, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad.
  Project Duration: 1997-1999
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **The effect of the ravages of war on the quality of Danube water**
  Division for Environment Protection and Advancement, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad.

Members of the Research Group

- Dr Dragan Radnović, associate professor
- Dr Slavka Gajin, full professor
- Dr Olga Petrović, full professor
- Dr Milan Matavulj, full professor
- Dr Zorica Svirčev, full professor
- Simeunović Jelica, MS, teaching assistant
- Maja Karaman, MS, teaching assistant
- Petar Knežević, MS, junior researcher
- Miloš Bokorov, BS (Biology)
- Sanda Savić, technician

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Cooperation

- Institute of Public Health of Vojvodina, Novi Sad
- CECRA, UNS, Faculty of Sciences, Department of Chemistry
- Faculty of Sciences in Nis
- Chair of Pharmacy, Faculty of Medicine in Nis
- Faculty of Sciences in Banja Luka

Equipment

- Lyophilizer Freeze Dryer ALPHA 2-4Ldplus, Donau Lab, Zurich, Switzerland; Investments into capital equipment for scientific research, The Ministry of Science and Technological Development of the Republic of Serbia.
- Epifluorescence microscope BX51 and fluorite oil objective 100x; Olympus, Japan; Investments into capital equipment for scientific research, The Ministry of Science and Technological Development of the Republic of Serbia.

Lyophilizer Freeze Dryer ALPHA 2-4LDplus

Project Duration: 1997-1999
Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad

- **Microbiological and ecological investigations on the location "Ratno Ostrvo"**
  Division for Environment Protection and Advancement, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad.
  Project Duration: 2000-2002
  Project Leader: Prof. Olga Petrović, Faculty of Sciences, Novi Sad.
- **The effect of war ravaging and riverbed cleaning on the water quality of the Danube near Novi Sad (Sapromicrobiological aspect)**
  Division for Environment Protection and Advancement, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad, 2001.
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Hydrobiological investigations of the DTD Canal network with the aim of rational utilization and sustainable development of the resource.**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 1945; 2002-2004
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Revitalization of the Kovilj Marsh**
  Ministry of Health and Environmental Protection of the Republic of Serbia, Division for Environmental Protection
  Project Duration: 2002-2004
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Microbiological and ecological aspects of the protection of groundwaters, water supply sources of the City of Novi Sad**

Selected References

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2. Karaman A.M., Mimica-Dukic M.N., Matavuly N.M. (2009): Lignicolous fungi from northern Serbia as natural sources of antioxidants. *Central European Journal of Biology* (in press).
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13. Matavulj M., Molitoris, H.P., (1992): Fungal degradation of polyhydroxyalkanoates and semiquantitative assay for screening their degradation by terrestrial fungi. *FEMS Microbiology Reviews*; 103: 323-332.
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Division for Advancement and Environment Protection, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad, 2003
Project Leader: Prof. Olga Petrović, Faculty of Sciences, Novi Sad.

- **Study of the microbiological quality of groundwaters to assess the endangerment and protection of the Novi Sad water supply sources and effect of contamination on the water quality in the distribution network**
  Division for Advancement and Environment Protection, Secretariat for Urbanism, Housing and Environmental Protection of the City of Novi Sad, 2005-2008
  Project Leader: Prof. Olga Petrović, Faculty of Sciences, Novi Sad.
- **Strategic Document "Fundamental Directions of the Technological Development of AP Vojvodina" in the area of ecology and chemical engineering for the Program "Support to the Transfer of New Technologies BNT"**
  Provincial Secretariat for Science and Technological Development (2005-2006)
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Program of implementation of the strategy "Fundamental Directions of the Technological Development of AP Vojvodina" in the area of ecology and chemical engineering for the Program "Support to the Transfer of New Technologies BNT"**
  Provincial Secretariat for Science and Technological Development (2007-2008)
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **LIFE – LICENSE (LIFE TCY/BIH/041), Local Institutional Capacity Development in Environmental Sensitive Areas, European Union, (2002-2004)**
  Project Bearer: Department of Urbanism of the Republic of Srpska, a. d. Banja Luka.
- **Tempus project: Conversion Courses for Unemployed University Graduates in Serbia (CONCUR), 149009-Tempus-2008-RS-JPHES**
  Project Leader: Prof. Miroslav Plančak, University of Novi Sad.
  Project Participant: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Balance of water resources of Vojvodina – optimal management and sustainable development**
  Vojvodina Academy of Sciences and Arts: No.: 114-451-00655/205-01.
  Area of technical-technological and agricultural sciences, Provincial Secretariat for Science and Technological Development, 2005-2006

Project Leader: Prof. Milorad Miloradov, Faculty of Technical Sciences, Novi Sad.

- **Development of a system for quality control and advancement of the process of water protection, Fundamental Research, No.: 142058**
  Ministry of Science and Technological Development of the Republic of Serbia, 2005-2010
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.
- **Chemical characterization and biological activity of secondary biomolecules from plants and fungi and their interaction with xenobiotics, Fundamental Research, No.: 142036**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project Leader: Prof. Neda Mimica-Dukić, Faculty of Sciences, Novi Sad.
- **Improvement and utilization of the genetic potential for the yield of tobacco, hop and medicinal herbs**
  Ministry of Science and Environmental Protection of the Republic of Serbia
  Program of technological development with the participation for the period 2005-2007
  Project No.: 006844
  Project Duration: 2005-2007
  Project Leader: Dr Janoš Berenji, Scientific Institute of Field Crops and Vegetables, Novi Sad.
- **Improvement of assortment, production technology and primary processing field pumpkin (Cucurbita pepo) and marigold**
  Ministry of Science and Technological Development of the Republic of Serbia, Program of technological development with participation for the period 2008-2011
  Project Leader: Dr Vladimir Sikora, Scientific Institute for Field Crops and Vegetables, Novi Sad.

16. Gajin S., Gantar M., Matavulj M., Petrovic O. (1990): The long term investigation of the river Danube water Quality in the Yugoslav section according to microbiological parameters. *Water Science and Technology*; 22, 5, p. 39-44.
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19. Todorović R., Grujić S., Matavulj M. (1987): Effect of reaction endproducts on the activity of cellulolytic enzymes and xylanase of Trichoderma harzianum. *Microbios Letters*, 36: 113- 119.
20. Matavulj M., Flint K.P. (1987): A model for acid and alkaline phosphatase activity in a small pond. *Microbial Ecology*; 13 (2): 141-158.

LABORATORY FOR ANATOMY AND PLANT MORPHOLOGY

Members of the Research Group

- Dr Ljiljana Merkulov, full professor
- Dr Jadranka Luković, associate professor
- Dr Lana Zorić, teaching assistant

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PARTICIPATION IN PROJECTS

- **Assessing LArge – scale environmental Risks with tested Methods (ALARM),** CE-CT-2003-506675; Project financed within the Sixth Framework Programme (FP6) of the European Union, 2007-2009. Coordinator for Serbia: Prof. Ante Vujić, Faculty of Sciences, Novi Sad.
- **Diversity of flora of the Pannonian part of Serbia, threat of spreading of invasive weeds and their influence on health of people**
  Project No.: 143037, Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010.
  Project Leader: Prof. Pal Boža, Faculty of Sciences, Novi Sad.
  Objective: to study structural properties of particular plant organs of invasive species in dependence of the habitat.
- **Study of biological characteristics of the invasive allergic plant species *Iva xanthifolia* Nutt. (*Asterales, Asteraceae*) with the aim to establish monitoring of the populations**
  Project No.: VI-501-2/2006-28, Agency for Environmental Protection of the City of Novi Sad, 2006.
  Project Leader: Dr Pal Boža, Faculty of Sciences, Novi Sad.
- **Establishing the state of the population of allergic species *Iva xanthifolia* Nutt. 1818 (*Asteraceae*) on the territory of the City of Novi Sad**

Research activity of the Group is concerned with the study of structural adaptation of plants to the conditions of specific habitats (saline, steppe, etc.). The work is also focused on the study of the characteristics of plant organs of autochthonous and cultivated species with the aim of establishing those characteristics that may be useful in the plant selection and cross-breeding. Besides, the research is also partly directed toward the study of structural characteristics of medicinal herbs, as well as of the effect of heavy metals on structural and physiological characteristics of vegetative organs of cultivated plants and species that are considered as promising for phytoremediation of soils contaminated with heavy metals. Comparative morpho-anatomical investigations of different systematic plant groups enable elucidation of taxonomic problems, as well as establishing of the degree of kinship within a group.

RESULTS

1. Zoric, L., Merkulov, Lj., Lukovic, J., Boza, P., Polic, D. (2009): Leaf epidermal characteristics of *Trifolium* L. species from Serbia and Montenegro. *Flora* 204: 198-209.
2. Lukovic, J., Malencic, Dj., Zoric, L., Kiprovski, B., Merkulov, Lj., Boza, P. (2009): Anatomical and Antioxidant Properties of *Euphorbia nicaeensis* All. ssp. Glareosa. *Central European Journal of Biology*, (in press)
3. Polic D., Lukovic J., Krstic L., Boza P, Merkulov Lj, Knezevic A. (2009): Morpho-anatomical differentiation of *Suaeda maritima* (L.) Dumort. 1827. (*Chenopodiaceae*) populations from inland and maritime saline area. *Cent. Eur. J. Biol.*, 4(1), 117-129.
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Project No.: VI-501-2/2005-28, Administration for Environmental Protection of the City of Novi Sad, 2005
Project Leader: Prof. Ružica Igić, Faculty of Sciences, Novi Sad.

- **Wild allied species of cultivated plants: *Lathyrus* spp., *Trifolium* spp. and *Allium* sp.**
  Project No.: 1760, Ministry of Science and Technological Development of the Republic of Serbia 2004-2005.
  Project Leader: Prof. Borivoj Krstić, Faculty of Sciences, Novi Sad.
- **Taxonomic, biogeographic and autecological studies of flora and fauna**
  Project No.: 03E28, Ministry of Science and Technology, 1996-2000.
  Project Leader: Dr Smiljka Šimić, Faculty of Sciences, Novi Sad
- **Study of the flora and fauna of the Vojvodina ecosystem**
  Project No.: 0337, Ministry of Science and Technology, 1991-1995.
  Project Leader: Prof. Smiljka Šimić, Faculty of Sciences, Novi Sad.
- **Functional organization and regulation of biosystems**
  Ministry of Science and Technological Development of the Republic of Serbia, 1986-1990.
  Project Leader: Prof. Radmila Kovačević, Faculty of Sciences, Novi Sad.
- **Creation and utilization of genetic potentials of grain crops**
  Project No.: 1271, 1991-1995, Provincial Research Fund SAP Vojvodina
  Project Leader: Dr Srbislav Denčić, Institute of Grain Crops, Novi Sad.

Equipment

Cryostat Leica CM 1850 (Wus-Austria project), Image Analysing System Motic 2000.

Cooperation

International cooperation has been established with the Institute of Physiology of the Academy of Sciences of the Czech Republic

HIGHER PLANTS SYSTEMATICS AND PHYTOGEOGRAPHY

The Group's research activities are concerned with the areas of taxonomy, floristic and biogeographic investigations, along with ecophysiological studies, as well as study of the geography of alochthonous species.

LEADING OF PROJECTS

- **Aquatic macrophytes of the Danube River in Serbia – factors of indication and remediation**
  Project of the Republic of Serbia, Fundamental Research, 2005;
  Project Leader: Prof. Ružica Igić, Faculty of Sciences, Novi Sad.
  The project was focused on the realization of several essential goals: establishment and elucidation of the changes in composition and population of aquatic macrophytes by comparing them with the results from the period 2002-2004 and those of 2005. Contents of nutrients and heavy metals in the tissues of dominant species indicated the state of ecological circumstances in respect of the existence of chemical contamination of the water, riverbed and of the adjacent land; those river stretches were identified that were most endangered by pollutants; it was recommended to use fish species – hyperaccumulators as test organisms for the assessment of the degree of contamination as well as factors of remediation of especially endangered aquatic ecosystems. The obtained results were compared with those of the investigations performed in the other Danube countries.
- **Diversity of the flora of the Pannonian part of Serbia, threat of spreading of invasive weeds and their effect on human health.**
  Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010
  Project Leader: Prof. Pal Boža, Faculty of Sciences, Novi Sad.
  The main research direction is concerned with the biodiversity of the Pannonian part of Serbia and monitoring of adventive, especially invasive species in the autochthonous plant communities, both in terrestrial and aquatic ecosystems. In parallel, the research is carried out related to the diversity of pollinators of plant species in the group of flower flies (*Diptera, Syrphidae*). The third research direction encompasses the detection of those invasive weeds that represent potential allergens to human population.

Members of the Research Group

- Dr Pal Boža, full professor
- Dr Ružica Igić, full professor
- Dr Dragana Vukov, assistant professor
- Goran Anačkov, MS, teaching assistant
- Milica Rat, BS, junior researcher
- Slobodan Bojčić, BS, research associate
- Predrag Košutić, technician

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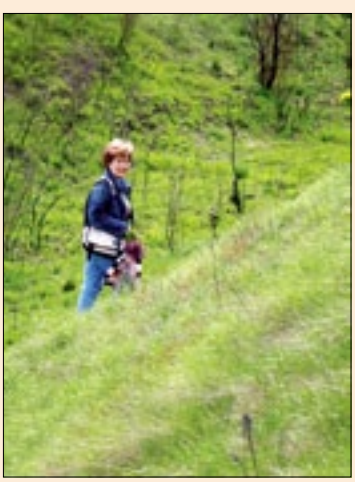

PARTICIPATION IN PROJECTS

- **MIDCC - Macrophytes, River Corridor, Land Use, Habitats: A multifunctional study in the Danube catchment based on GIS approach / Macrophyte Inventory Danube / Corridor and Catchment**

  The project was financed by the Ministry of Science and Culture of the Republic of Austria
  Project No.: IECB-MIDCC-45.512/2001
  Project Duration: 2001-2005
  Project Coordinator: Dr Georg A. Janauer, Department of Limnology and Hydrobotany, University of Vienna;
  Coordinator for Serbia: Prof. Ružica Igić, Faculty of Sciences, Novi Sad.
  Partners: Institut für Landschafts- und Pflanzenökologie Universität Hohenheim; Department of Limnology and Hydrobotany, University of Vienna, Vienna (Austria); Department of Geobotany; Institute of Botany Slovak Academy of Sciences, Bratislava (Slovakia); Museum of the Hungarian Culture & Danubian Region (Slovakia); Danube Research Station of the H.A.S. Ungar. Akademie der Wissenschaften (Hungary); University of Ljubljana, Biotechnical Faculty, Dept. of Biology, Ljubljana (Slovenia); Institute of Botany, Bulgarian Academy of Sciences, Sofia (Bulgaria); Association of the Romanian Botanical Gardens (AGBR), Bucharest (Romania); University Zagreb, Faculty of Science, Department of Biology, Botanical Institute, Zagreb (Croatia); University J.J. Strossmayer, Faculty of Education, Department of Biology, Osijek (Croatia).
  The main research objective was to study the flow of the Danube and its aquatic vegetation. Since the research was realized in cooperation with partners from all the Danube countries, the project was not only innovative but it also fulfilled the preset goals of the European Union for the inclusion into a multifunctional utilization and accessibility of the obtained results through the international cooperation. Investigation of

3. Gilles, F., Chalchat, J.-C., Petrović, S., Maksimović, Z., Gorunović, M., Boža., P., Radić, J.(2009): Composition of Essential Oil of flowers, Leaves, Stems and Rhizome of *Peucedanum officinale* L. (*Apiaceae*). *Journal of Essential Oil Research*, 123, Vol. 21, 123-126.
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aquatic vegetation in the main part of the river, as well as in flood zones, the determination of dominant parameters of the habitat, types and utilization of land and georeference database obtained for the whole Danube flow indicate that this project provided a dimension of multifunctionality that has not been realized previously in Europe.

- **Assessing LArge scale environmental Risks for biodiversity with tested Methods (ALARM)**
  Integrated Project under the 6th EU Framework Programme (FP6): GOCE-CT-2003-506675; 2004-2009.
  Project Coordinators: Josef Settele et al., Helmholtz Centre for Environmental Research – UFZ, Halle, Germany.
  Group Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad.
  The work on the theme Variability of species of the Ornithogalum genus on the territory of the Iberian Apennine and Balkan peninsulas, as well as on the samples from Aegean islands. The topic of the study was the infraspecies variability of the species from remote locations and formation of parallel taxonomic series. Selected taxons represent a species that is in close relation to the way of life of the insects (order *Diptera*, family *Syrphidae*).
- **Atlas Florae Europaeae – European Committee for Mapping the Flora of Europe, Societas Biologica Fennica Vanamo**
  Long-term project
  Project Leaders: Kurtto, A., Fröhner, S.E., Lampinen, R, Finland.
  Coordinator of the Group in Serbia: Prof. Vladimir Stevanović, Faculty of Biology, Belgrade.
  Participants from the Laboratory: Prof. Pal Boža and Goran Anačkov, MS, Faculty of Sciences, Novi Sad.
  Collecting data about the chorology of plant species on the territory of Europe (participants from the Laboratory have the task to do that in the area of the southern brim of the Pannonian Plain). Revision of the herbarium material, analysis of the literature data, formation of the corresponding database and mapping in the UTM networks of 50x50 km.

- **Wild relatives of cultivated plants**
  ***Trifolium* spp., *Lathyrus* spp. and *Allium* spp.**
  Project of the Republic of Serbia – Fundamental Research: Project No.: 1760, 2004-2005.
  Project Leader: Prof. Borivoj Krstić, Faculty of Sciences, Novi Sad.
  The project is based on the joint investigations of several groups engaged on the problem of identification and study of biological characteristics of autochthonous relatives of cultivated plant species. The work of the Laboratory members encompassed the inventory of the species and infraspecies taxons in the region of Vojvodina which are close relatives to cultivated species of the orders *Trifolium, Lathyrus* and *Allium*. The infraspecies variability of the vegetative and generative organs was compared with those of cultivated species.
- **Botanically important plant areas (IPA) in Serbia**
  Financed by the IPA in Serbia
  Ministry of Environmental Protection of the Republic of Serbia, Project No.: 401-00-264/2002-01, 2002 - 2010.
  Project Leader: Prof. Vladimir Stevanović, Faculty of Biology, Belgrade.
  Group Coordinator for Vojvodina: Prof. Pal Boža, Faculty of Sciences, Novi Sad.
  Analysis of the qualitative composition of the flora and vegetation on particular locations in Vojvodina and their evaluation. Formation of the database on the species and plant communities in the given region, degree of their endangerment and protection. Field assessment of the state and the introduction into the database (IPA system). Assessment of the territory of the corresponding IPA Harmonizing habitat diversity on the given IPA with the European standards.
- **Red Book of the Flora of Serbia 2**
  Ministry of Environmental Protection of the Republic of Serbia; Project No.: 401-00-544/2003-01, 2003 – 2010.
  Project Leader: Prof. Vladimir Stevanović, Faculty of Biology, Belgrade.
  Group Coordinator for Vojvodina: Prof. Pal Boža, Faculty of Sciences, Novi Sad.
  Taxonomic and chorologic analyses of plants from the group of species. Defining the areals on the territory of Serbia and critical survey of the literature data and herbarium collections. Mapping of the locations of endangered species. Defining the phytogeographical importance of the endangered species, degree of endangerment and abundance of natural populations. Analysis of the endangerment factors and assessment of the state of the population in the forthcoming period.
- **Flora of Serbia**
  Serbian Academy of Sciences and Arts (SASA) – long-term project of SASA, Editor Prof. Mirko Škorić, corresponding member of SASA.
  Project Leader: Prof. Vladimir Stevanović, corr. memb. of SASA.
  Capital floristic work of highest national significance. Revision of the flora of the Republic of Serbia issued in the 1970s. Taxonomy and chorology of all plant groups present in the flora of Serbia. Elaboration of the determinators for the species and infraspecies categories. Defining taxon diagnosis from the flora of Serbia, mapping of the diffusion.

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Members of the Research Group

- Dr Ružica Igić, full professor – Head of the Laboratory
- Dr Pal Boža, full professor
- Dr Dragana Vukov, assistant professor
- Goran Anačkov, MS, teaching assistant
- Slobodan Bojčić, BS, professional associate
- Predrag Košutić, technician

LABORATORY FOR AMBROSIA AND OTHER ALLERGIC PLANTS

Activities of the Laboratory are primarily related to the monitoring of population of allergic plants and mechanisms of their spreading, survey of the level of their ecological plasticity, as well as the system of mechanical and biological control of invasive allergic plants. In this respect, intensive cooperation has been established with the Provincial Secretariat for Environmental Protection, Provincial Secretariat for Agriculture, Water Resources Management and Forestry, the City Building Division, the Municipal Authorities, Office for Environmental Protection, the Municipal Authorities Office for Municipal Works and the Center for controlling Ambrosia and other allergic plants.

With the support of the Municipal Authorities Office for Environmental Protection, the Laboratory members issued the publication "Atlas of Allergic Plants of Novi Sad" (in Serbian), published by the Faculty of Sciences, Novi Sad.

When needed, the Laboratory in its research includes also the members from the other laboratories of the Department of Biology and Ecology of the Faculty of Sciences in Novi Sad, and Faculty of Medicine in Novi Sad.

PROJECTS

- **Establishing the state of the population of allergic species Iva xanthifolia Nutt. 1818 (*Asteraceae*) on the territory of Novi Sad**
  Project No.: VI-501-2/2005-28, 2005, the Municipal Authorities, Office for Environmental Protection, City of Novi Sad.

- **Mapping of the areas under Ambrosia and other allergic plants, laboratory and field investigations and monitoring.**
  Project No.: 352-1/2006-316-II, 2006, Municipal Authorities, Office for Environmental Protection, City of Novi Sad.
- **Study of biological characteristics of invasive allergic species *Iva xanthifolia* Nutt. 1818 (Asterales, Asteraceae), with the aim of establishing a monitoring system of the population.**
  Project No.: VI-501-2/2006-28, 2006, Municipal Authorities, Office for Environmental Protection, City of Novi Sad.
- **Mapping of the areas under *Ambrosia* and other allergic plants, laboratory and field investigations and monitoring**
  Project No.: III-352-1/2007-350, 2007, Municipal Authorities, Office of Municipal Works, City of Novi Sad.
- **Forming the strategy to control spreading of the population of invasive allergic plant *Iva xanthifolia* Nutt. (Asterales, Asteraceae) on the territory of Novi Sad**
  Project No.: VI-501-2/2007-28, 2007, Municipal Authorities, Office of Environmental Protection, City of Novi Sad.

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Studies

- Mapping and monitoring of allergic plants on the territory of City of Novi Sad and the possibility of their control 2002, Municipal Authorities, Office for Environmental Protection, City of Novi Sad.

LABORATORY FOR PALYNOLOGY

Members of the Research Group

- Dr Smiljka Šimić, full professor
- Predrag Radišić, MS, teaching assistant
- Branko Šikoparija, PhD student
- Tatjana Pejak-Šikoparija, BS, professional associate
- Bojana Stanisavljev, biology student
- Jelena Božović, biology student

Contact Person

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Equipment

- Five Hirst apparata for sampling of aerospores and aeropollen (4 "Lanzoni", 1 "Burkard")
- Trap for daily accumulation of indoor spores ("Lanzoni")
- Systemic microscope Olympus BX-51
- Laboratory microscopes: Olympus CX-31
- Digital camera "Leica" DFC320 and software package for the systemic microscope
- Two high-power suction setups for indoor allergens
- Laboratory equipment for honey analysis
- Literature: Aerobiology, Aeropalynology, Mellisopalynology, Entomopalynology, Paleopalynology, Archeopalynology

The Laboratory for Palynology of the Faculty of Sciences has been engaged on the study of pollen since 1989 in the frame of the entomopalynological studies of flying flies (*Diptera*: *Syrphidae*). The Laboratory possesses international certificates of competence for carrying out aerobiological investigations as well as the EAN (European Aeroallergen Network) recommendation for monitoring of aeroallergens. The project of aeropalynological measurements and research commenced on March 17, 1999, and presently the Laboratory carries out monitoring of aeropollen in six towns of Serbia. In the frame of the aeropalynological studies the Group has actively participated in a number of domestic and international projects.

In addition to the analysis of pollen from the air, the Laboratory is also concerned with the analysis of fungal spores as well as with the study of house dust mites (*Pyroglyphydae* – especially the order *Dermatophagoides*).

Independently of the aerobiological studies, since 2002 the Laboratory has also been engaged in mellisopalynological studies, including quantitative and qualitative analyses of honey-suspended pollen, with the aim of determining the quality and geographic origin of this honeybee product.

LEADING OF PROJECTS

- **CEP (Center for Excellence Project) "Aerobiological research of Novi Sad and its surroundings" funded by WUS Austria (2003)**
  Project Leader: Prof. Smiljka Šimić, Faculty of Sciences, Novi Sad.
- **BGP (Brain Gain Project) funded by WUS Austria (2005)**
  Project Leader: Prof. Ante Vujić, Faculty of Sciences, Novi Sad
- **CDP+ (Course Development Program) "Palynology" funded by WUS-Austria (2006)**
  Project Leader: Prof. Smiljka Šimić, Faculty of Sciences, Novi Sad.
- **"Monitoring of aeropollen in Novi Sad", Municipal Government, Office for Environmental Protection, City of Novi Sad (2000-2008)**
  Project Leader: Prof. Smiljka Šimić, Faculty of Sciences, Novi Sad.
- **"Monitoring of aeropollen in Ruma", Provincial Secretariat for Environmental Protection and Sustainable Development, AP Vojvodina, (2003-2007)**
  Project Leader: Predrag Radišić, MS, Faculty of Sciences, Novi Sad.
- **"Monitoring and forecasting of the state of aeropollen in Niš", Municipal Authorities for Economy, Sustainable Development and Environmental Protection, City of Niš (2006-2009)**
  Project Leader: Predrag Radišić, MS, Faculty of Sciences, Novi Sad.
- **"Monitoring and forecasting the state of aeropollen in Sombor and Zrenjanin", Provincial Secretariat for Environmental Protection and Sustainable Development, AP Vojvodina (2008)**
  Project Leader: Predrag Radišić MS, Faculty of Sciences, Novi Sad.
- **"Characteristics of the occurrence of aeropollen of Iva xanthifolia Nutt.", Provincial Secretariat for Environmental Protection and Sustainable Development, AP Vojvodina (2008)**

Project Leader: Predrag Radišić, MS, Faculty of Sciences, Novi Sad.

- **"Monitoring of aeropollen in Zrenjanin, Sombor, Sremska Mitrovica and Vrbas", Provincial Secretariat for Environmental Protection and Sustainable Development, AP Vojvodina (2009), 2008**
  Project Leader: Predrag Radišić, MS, Faculty of Sciences, Novi Sad.
- **"Identification and monitoring of indoor allergens in the Novi Sad kindergartens", Office for Environmental Protection and Office for Education, City of Novi Sad (2006)**
  Project Leader: Prof. Smiljka Šimić, Faculty of Sciences, Novi Sad.
- **Organization of the international regional meeting "Living without Ambrosia" (2003, 2005)**

PARTICIPATION IN PROJECTS

- **SCOPES JRP Br. IB73A0-11103 "Monitoring and forecasting airborne ragweed pollen concentrations in the South-Eastern part of its European distribution", funded by Swiss National Science Foundation (2006-2008).**
  Project Coordinator: Dr Bernard Clot, Meteoswiss, Payeren, Switzerlan.
- **COST Action ES0603 "Assessment of production, release, distribution and health impact of allergenic pollen in Europe (EUPOL)"**

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AEROPALYNOLOGY

- International certificates: 6th European Basic Course on Aeropalinology; 6th Advanced Aerobiology Course; "Aerobiology and Health"; NPARU (National Laboratory for Palynological and Aerobiological Research, Great Britain).
- Membership in the International Aerobiological Association (IAA) from 2006.
- Membership in the Committee of the European Aerobiological Society (EAS) from 2008.
- Members, one of the foundation teams for Ambrosia control and the realizer of the project "Living without *Ambrosia*" 2003-2005.
- Participation in founding the European Aeroallergen Network (EAN); the European Pollen Information (EPI) system; Aeropollen Service for the Euro-region Danube-Keres-Maros-Tisa; and MEDAERONET database
- Informing people and public sources about the state of aeroallergens and forecast for the coming period (reports for various media)

MELISSOPALYNOLOGY

- Membership in the International Honey Commission (IHC) from 2006.
- Participation in scientific and professional meetings
- Mastering melissopalynological analyses and their application
- Participation (Chairman) of the expert team for establishing criteria for the prize "Best from Vojvodina"

ENTOMOPALYNOLOGY

- Study of pollen transport and pollen nutrition of the species of the family *Syrphidae* (Insecta: Diptera)
- Participation in scientific and professional meetings

ACTIVITIES

- Introduction and organization of the facultative course Palynology at the Faculty of Sciences, Novi Sad
- Organization of the 8th European Basic Course on Aaerobiology, Novi Sad, July 12- 18, 2007.
- Organization of the program of professional training "Pollen All Around Us" and "Applied Palynology" for teachers

The Laboratory has also realized the activity like Ergomed Clinical Research Ltd. "Report on mean daily concentrations of aeropollen of the species of the order *Ambrosia*" for the needs of the study: "Randomized, double-blind, placebo controlled study in parallel groups to assess the efficiency of oral application of microcapsule extract of *Ambrosia* pollen prior and during the *Ambrosia* season", RPE04 Protocol, Sponsored by CURALOGIC A/S, Denmark; qualitative and quantitative analyses of pollen in honey (Novi Sad Honey Festival 2002, 2003; Competition "Best from Vojvodina" 2006-2008).

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Participation in meetings in 2008

7. Jäger, S., Šikoparija, B., Yankova, R., Radišić, P. 2008: Prediction of severity of *Ambrosia* seasons by means of linear regression models. 8th European Pollen Symposium, Bad Lippspringe, Germany. (Abstract)
8. Šikoparija, B., Smith, M., Skjøth, C. A., Radišić, P., Milkovska, S., Šimić, S. and Brandt, J. 2008: The Pannonian Plain as a source of *Ambrosia* pollen in the Balkans. 4th European Symposium on Aerobiology, Turku, Finland. (Abstract)
9. Šikoparija, B., Smith, M., Skjøth, C. A., Radišić, P., Milkovska, S., Šimić, S. and Brandt, J. 2008: The Pannonian Plain as a source of *Ambrosia* pollen in the Balkans. 1st International Ragweed Symposium, Budapest, Hungary. (Abstract)
10. Radišić, P., Šikoparija, B., Jankova, R., Milkovska, S., Pejak-Šikoparija, T., Šimić, S., Gjebrea-Hoxa, E. 2008: Ragweed airborne pollen in Southern Pannonian plain and Balkan peninsula. 2nd International Symposium Intractable Weeds and Plant invaders, Osijek, Croatia. (Abstract)
11. Stanisavljev, B., Šikoparija, B., Radišić, P., Pejak-Šikoparija, T., Šimić, S., Gjebrea-Hoxa, E. 2008: The effect of mowing to pollen production of *Ambrosia artemisiifolia* L. 2nd International Symposium Intractable Weeds and Plant Invaders, Osijek, Croatia. (Abstract)
12. Božović, J., Stanisavljev, B. and Grewling, L. 2008: Comparison of the pollen season of the most allergenic taxa between Novi Sad (Serbia) and Poznan (Poland) in 2007. 3rd International Symposium of Ecologists of Montenegro, Herceg Novi, Montenegro. (Abstract)

Professional article

13. Šikoparija, B., Radišić, P., Hunjadi, V. 2007: How to get the tag "Best from Vojvodina" for lime honey from Fruska Gora mountain. Meeting of Beekepers 25, Novi Sad, 63-68. (in Serbian)

Book

14. Šimić, S. Radišić, P., Šikoparija, B., Dulić, I. 2007: Palynology. ISBN 86-906211-9-9, Novi Sad. 98 pp. (in Serbian)

HERBARIUM – BUNS

Department of Biology and Ecology
Faculty of Sciences
University of Novi Sad

The work of the Herbarium: collecting of materials and taxonomic expertise. The Herbarium is organized in six collections: General Collection contains more than 80,000 desiccated specimens from the Central and West Europe, South Europe, especially from the Balkan Peninsula, countries of the former Yugoslavia, and North America. The majority of its specimens come from the region of the southern brim of the Pannonian Plain. The basis of the collection represents the Herbarium of the former Pedagogical College in Novi Sad, 4000 specimens. The Herbarium also possesses the collection of almost 1000 seed specimens, as well as a cecidia collection with about 200 specimens. A separate division makes special collections of taxonomic investigations, with a large number of specimens, as well as the Collection of voucher specimens. The Herbarium possesses 60 type specimens, as well as specimens of particular species that vanished from the territory of Serbia. In the Vojvodina region, the Herbarium BUNS is the only internationally recognized herbarium and one of the three in Serbia.

Members of the Research Group

- Dr Pal Boža, full professor
- Dr Ružica Igić, full professor
- Dr Dragana Vukov, assistant professor
- Goran Anačkov, MS, teaching assistant
- Milica Rat, BS, junior researcher
- Slobodan Bojčić, BS, professional associate
- Predrag Košutić, technician

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LABORATORY FOR PLANT ECOLOGY

Members of the Research Group

- Dr Mirjana Vučković, full professor
- Dr Snežana Radulović, assistant professor
- Dušanka Laketić, MS, junior researcher
- Darko Majkić, BS (Biology), volunteer
- Anamarija Fejsa, BS-master (Biology), junior researcher

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Cooperation

Participation of the Group in the preparation and standardization of scientific methods based on biological and ecological parameters in the determination of the ecological status of aquatic ecosystems in the frame of the CEN group, as well as its active application and testing, have resulted in an intensive international cooperation with universities from Great Britain, Ireland, Poland, The Netherlands, France, and Italy. An outcome of this cooperation is also the possibility for professional training of students of doctoral studies, first of all at the University of Dundee in Scotland and University of Dublin in Ireland.

The vegetational (phytocenological) investigations under the guidance of Prof. Mirjana Vučković are related to numerous teaching and research activities focused on aquatic and semiaquatic macrophytes of plain lakes and canals.

In the frame of this working group, in the research concerning the ecological status of aquatic ecosystems, an intensive work is carried out on the development and implementation of a number of new standard Pan-European methods - RHS (*River Habitat Survey*), LHS (*Lake Habitat Survey*), SERCON (*System for Evaluating Rivers for Conservation*), under the guidance of Assist. Prof. Snežana Radulović, member of ISO KSH 147 of the Republican Department for Standardization and representative of the Republic of Serbia in CEN (*Comité Europeén de Normalisation*) Commission of the European Union, Technical Committee TC 230, WG2 for Water Analyses WG2.

LEADING OF PROJECTS

- **Survival of plant and animal world in aquatic ecosystems in the Novi Sad surroundings**
  Project was financed by the Municipal Authorities – Secretariat for Urbanism, Municipal Works and Environmental Protection, Novi Sad. Period: 1999-2001.
  Project Leaders: Prof. Mirjana Vučković and Prof. Ester Popović, Faculty of Sciences, Novi Sad.

Research work on the Kerkini Lake, Greece

Field work – Durmitor, Crno jezero, Ludaško jezero

- **Implementation of the Water Directive in determining the ecological status of the Natural Park "Jegrička" by SERCON method (2008/2009)**
  The project was financed by the Public Water Management Company "Vojvodina Waters". Period: 2008.
  Project Leader: Assist. Prof. Snežana Radulović, Faculty of Sciences.

PARTICIPATION IN PROJECTS

- **Ecological investigations of aquatic ecosystems (the Canal Danube-Tisa-Danube) aimed at a rational and sustainable development of resources**
  Federal Ministry of Science, Technology and Development (OSI147/1-93).
  Period: 1994-2000.
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Hydrobiological investigations of the canal network DTD aimed at a rational and sustainable development of resources**
  Ministry of Science, Technology and Development of the Republic of Serbia (Project No.: 1945). Period: 2002-2004.
  Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
- **Important Plant Areas (IPA) in Serbia**
  The project was financed by the IPA (Important Plant Areas) in Serbia.
  Ministry of Environmental Protection of the Republic of Serbia (Project No.: 401-00-264/2002-01).
  Period: 2002 - 2010
  Project Leader: Prof. Vladimir Stevanović, Faculty of Biology, Belgrade
  Project coordinator for Vojvodina: Dr Pal Boža, Faculty of Sciences.
- **Red Book of Flora of Serbia 2**
  Ministry of Environmental Protection of the Republic of Serbia (Project No.: 401-00-544/2003-01)
  Period: 2003 – 2010
  Project Leader: Prof. Vladimir Stevanović, Faculty of Biology, Belgrade

Equipment

Trimble Nomad represents a robust pocket computer with integrated GPS receiver and series of advanced options that enable position reading and more precise field work.
The instrument was purchased in 2008 in the frame of the HP Interactive mobile technology in Mathematical and Science Courses (US Philanthropy program, coordinator: Prof. Dusanka Perišić), and it represents the last generation of GPS device, as well as the GIS software Trimble Terrasync Professional.

Slano kopovo

Project Coordinator for Vojvodina: Prof. Pal Boža, Faculty of Sciences, Novi Sad.

- **Flora of Serbia**
  Serbian Academy of Sciences and Arts (SASA) – long-term project of SASA, Editor Prof. Mirko Škorić, Corresp. member of SASA.
  Project Leader: Prof. Vladimir Stevanović, Corresp. Member of SASA.
  Capital floristic work of national significance.

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9. Pajević, S., Vučković, M., Stanković, Ž., Krstić, B., Kevrešan, Ž., Radulović, S. (2002): The content of some macronutrients and heavy metals in aquatic macrophytes of three ecosystems connected to the Danube in Yugoslavia. *Large Rivers* Vol. 13, No. 1-2; *Archiv für Hydrobiologie Suppl.* 141/1-2, 73-83.
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12. Vučković, M., Radulović, S., Strajin, D. (1999): Adventive plants – comers along with aquatic biotopes of the Northern Backa. Monograph of the Northern Backa waters, Edition "Tija voda", Pčesa '99 (ed. Milošev), Novi Sad. (in Serbian).
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CEN COMMISSION

Participation in the preparation of CEN documents

- N96 Phytoplankton biovolume determination using inverted microscopy (Utermöhl technique)
- Guidance on quantitative and qualitative sampling of phytoplankton from inland waters
- N94 Water quality – Guidance standard for the surveying, sampling and laboratory analysis of phytobenthos in shallow running water
- N90 – Guidance standard for lake macrophyte
- N48 Water Quality – Guidance Standard on the design and analysis of interlaboratory calibration studies for ecological assessment
- N49 Position paper on a guidance standard on the quantification and use of performance characteristics in ecological assessment methods
- N53 Water quality – guidance standard on assessing river quality based on hydromorphological features
- N54 Water Quality - Standard parameters for the general inspection, characterization and interpretation of hydro-morphological properties of lakes

Participation in the CEN work:

- May 2005, Bratislava, Slovakia
- December 2005, Edinburgh, UK
- June 2006, Gothenburg, Sweden
- November 2006, London, UK
- May, Vienna 2007
- May 2008, Hof, Germany
- February 2009, Brussels, Belgium
- May 2009, Lelystad, The Netherlands

LABORATORY FOR PLANT PHYSIOLOGY

Research work of the Group for Plant Physiology has yielded the realization of numerous scientific projects in the country and abroad. Currently, the Group is engaged on the project of the Ministry of Science and Technological Development of the Republic of Serbia entitled "Creating of poplar and willow species in multifunctional plantations" carried out in cooperation with the Scientific and Developmental Institute for Lowland Forestry and Environment in Novi Sad, in the frame of which the research team deals with the potentials of poplar and willow in phytoremediation.

LEADING OF PROJECTS

- **Phytoremediation of contaminated soils and waters with the aid of poplar clones**
  Ministry of Science and Environmental Protection; 2005 - 2008
  Project Leader: Prof. Borivoj Krstić, Faculty of Sciences, Novi Sad.
  In the environmental monitoring, an important role has the determination of heavy metals and other pollutants that are loading sediments, soils, atmosphere, and plants. Starting from the fact that different plant species and their genotypes take up different amounts of heavy metals, the project encompassed poplar and willow and their clones, aimed at selecting those that are most suitable for phytoremediation.
- **The role of plants in the indication of the removal of pollutants (heavy metals) along the main road to Fruska Gora mountain (Paragovo), 2006, City of Novi Sad**

Plant germination

Members of the Research Group

- Dr Borivoj Krstić, full professor, (mineral nutrition, water regime, phytoremediation, photosynthesis, research methods in biology)
- Dr Slobodanka Pajević, full professor, (photosynthesis, water regime, mineral nutrition, physiology of aquatic plants, phytoremediation)
- Nataša Nikolić, MS, teaching assistant, (poplar phytoremediation, mineral nutrition, plant enzymes, photosynthesis, physiology of woody plant species)
- Milan Borišev, MS, teaching assistant, (willow phytoremediation, uptake and metabolism of heavy metals, mineral nutrition, ecology and distribution of aquatic plants)
- Sanja Muzikravić, technician (work on laboratory instruments, methods of plant growing)

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Teaching experiment in the Laboratory for Plant Physiology

Project Leader: Prof. Borivoj Krstić, Faculty of Sciences, Novi Sad.
Defining the role and potential of plants in the decontamination of the areas polluted with heavy metals. The use of plants for creating protection belts.

- **Wild relatives of cultivated plants *Lathyrus* spp., *Trifolium* spp. and *Allium* spp**
  Ministry of Science and Environmental Protection; 2001 - 2003
  Project Leader: Prof. Borivoj Krstić, Faculty of Sciences, Novi Sad.
  The objective of these investigations was to bring together the data about spatial distribution and frequency of the species of the orders: *Lathyrus*, *Trifolium* and *Allium* and their intraspecies taxons with the aim of preserving the source genofund, that is breeding plants for biomass production, persistence (increasing life span), nitrofixation, and other agronomic values of wild peas, clovers, and onions.

PARTICIPATION IN PROJECTS

- **Creating poplar and willow varieties for growing in multifunctional plantations**
  Ministry of Science and Technological Development of the Republic of Serbia; 2008 – 2011.
  Project Leader: Dr Saša Orlović, Institute of Lowland Forestry and Environment, Novi Sad.
  The objective of the project is to create high-quality genotypes of poplar and willow, endowed with lush growing, resistance against diseases and harmful insects, favorable morphological properties of the trunk

Equipment

The Laboratory is equipped with a spectrophotometer, flame photometer, photoelectric photometer, fluorescent stress meter, mobile setup for measuring intensity of photosynthesis and transpiration, Clark oxygen electrode for measuring intensity of photosynthesis and breathing, Geiger-Muller counter, chambers and greenhouse for plant growing under artificial conditions with the accessories, Kjeldahl system for protein determination for the purpose of laboratory analyses and teaching.

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2. Nikolić, Lj., Pajević, S., Ljevnajić, B. (2009): Primary production dynamics of dominant hydrophytes in Lake Provala (Serbia). *Central European Journal of Biology* 4(2), 250-257.
3. Pajević, S., Igić, R., Stanković, Ž., Vukov, D., Krstić, B., Rončević, S. (2008): Chemical compositions of aquatic macrophytes from the Danube River and their role in biomonitoring and bioremediation. *Large Rivers* 18, No. 1-2, 351-360.
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8. Krstić, B., Boža, P.(2008): Plant Aging, Dying and Disappearing. Life and Death of Biological Organisms: Man and Nature (Ed. Nikolić, D.), Matica Srpska, Novi Sad, 71-82. ISBN 978-86-7946-021-9. (in Serbian)

(straightness, branching, etc.), capability to grow on a wide range of soils, favorable physical and chemical characteristics of the wood, high biomass production and thermal value, good rooting, tolerance to herbicides, high capacity for remediation of contaminated soils and waters, as well as favorable characteristics in respect of physiological parameters (photosynthesis, breathing, water regime, etc.).

- **Cross-breeding, technology and utilization of pepper, tomato and water melon**
  Ministry of Science and Environmental Protection; 2005-2009, Project No.: 6848.
  Project Leader: Dr Djura Gvozdenović, Institute of Field Crops and Vegetables, Novi Sad
  The project objective was to select high-quality strains of pepper, tomato and water melon for the production and utilization in nutrition and in the industry.
- **Diversity of the Pannonian part of Serbia and its endangerment by the spread of invasive weed and their effect on human health**
  Ministry of Science and Environmental Protection; 2007; Project No.: 143037.
  Project Leader: Prof. Boža Pal, Faculty of Sciences, Novi Sad.
  Physiological analyses in the frame of this project were focused on monitoring of the parameters of gas exchange, efficiency of utilization of water and nitrogen of different strains of *Ambrosia artemisiifolia* L., *Ambrosia trifida* L. and *Iva xanthifolia* Nutt., in order to define their potential for invading our habitats. Also, contents of particular biogenic organic volatile compounds that exhibit allergenic effects of these species to man have been assessed.
- **Hydrobiological investigations of the DTD Canal network with the aim of rational and sustainable development of resources.**
  Ministry of Science and Environmental Protection; 2000 - 2006; Project No.: 1945.

Aquatic willow cultures under controlled conditions in the glasshouse

Measuring photosynthesis in field conditions

Project Leader: Prof. Milan Matavulj, Faculty of Sciences, Novi Sad.
Studies of aquatic ecosystems are related to the possibility of purification of water and adjacent land areas utilizing water vegetation with the aim of removal of heavy metals and other pollutants.

- **Breeding of sunflower and development of new growing technologies**
  Ministry of Science and Environmental Protection; 2000 - 2006; Project No.: BTR. 5.02.0401.B
  Project Leader: Prof. Jovanka Atlagić, Faculty of Sciences, Novi Sad.
  In the frame of defining and developing new plant growing technologies special attention is paid to the factors that are important in the process of breeding. The objective was to point out the importance of the genetic background in determining biochemical characteristics of the calus. By establishing the different needs for nutrients one obtains information that may lead to the improvement of the efficiency of regeneration of plants cultivated under *in vitro* conditions, using specific substrates for their growing.

9. Krstić, B., Stanković, D., Igić, R., Nikolić, N. (2007): The potential of different plant species for nickel accumulation. *Biotechnology & Biotechnological Equipment* 21: 431-436.
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12. Borišev, M., Krstić, B., Pajević, S., Pilipović, A., Nikolić, N., Orlović, S. (2006): Biomass production of willow clones in the presence of cadmium. In: Lj. Rakonjac (Ed.), Sustainable Use of Forst Ecosystems. Proceedings of International Scientific Conference, Donji Milanovac, Serbia. pp. 488-492.
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LABORATORY FOR TAXONOMY AND ZOOGEOGRAPHY OF INVERTEBRATES

Members of the Research Group

- Dr Ivo Karaman, assistant professor
- Dr Laslo Barši, assistant professor
- Mladen Horvatović, PhD student, junior researcher

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Cooperation

- Istituto per la Protezione delle Piante, Bari, Italy
- Institut für Zoologie, Mainz, Germany
- Department of Organismic and Evolutionary Biology, Harvard University, USA
- Department of Biology, San Diego State University, USA
- Institute of Zoology, Karl-Franzens-University, Graz, Austria

The research activity of the Group is concerned with taxonomic, phylogenetic and biogeographic studies of different groups of invertebrates. In view of this the work of the Group is oriented in two directions.

The first research direction is concerned with the determination of the key moments and mechanisms of diversification of the old Balkan flora. The research area and its zones on the east and west are mainly populated with the identical and characteristic complex of faunistic elements. The region of the Balkan Peninsula was chosen because of its pronounced diversification of representative groups of fauna which began at the northernmost regions of Gondwana still in the chalk era. The research focus is on the representatives of selected groups of old arthropod fauna of different forms, i.e. their taxonomy in zoogeography:

1. Taxonomy, phylogeny and biogeography of harvestmen spider (*Opiliones*), with a special emphasis on *Cyphophthalmi*. This old group of harvestmen, of extremely high degree of endemicity is very widespread on the Balkans. Because of their oldness and poor vagility, the species of this group appear as excellent biogeographical indicators.
2. The *Trichoniscidae* family is one of the oldest families of terrestrial Isopoda, whose diversity center is the Mediterranean, mainly the Balkans. They represent an object of special interest since the Balkan region is a most important center of diversification of this family.
3. The research is also partly concerned with *Orthoptera*, first of all with some genera of terricolous and tamnobiont Ensifera, present in the Balkans as numerous endemic species.
4. The Group pays special attention to the study of edaphic fauna of MSS (mesovoid shallow substratum) and cavernicolous environment (caves and holes) of the mentioned animal groups, where endemic elements of the old Balkan fauna are dominant.

The other research direction is focused on phytoparasitic soil nematodes from the family *Longidoridae*. Being poorly vagile, they are suitable for biogeographic investigations. Of special interest are oligophagous species because of their close link to particular host plants. Studies of the species whose distribution is under strong anthropogenic influence have another dimension, first of all agroeconomical phytosanitary.

In the research, use is made of different taxonomic method (classical morpho-anatomic procedures, scanning electron microscopy, and molecular analysis).

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PARTICIPATION IN PROJECTS

- **Functional analysis of ontogenetic diversification of fauna and modification of evolutive responses during the phylogeny, ON143053.**
  Project is financed by the Ministry of Science and Technological Development of the Republic of Serbia
  Project Leader: Prof. Božidar Ćurčić, Faculty of Biology, Belgrade.

LABORATORY FOR ANIMAL ECOLOGY

The Group is involved in the ichthyologic studies, as well as in studies of nutrition and fauna of endoparasites of amphibians, birds and mammals. Special expertise is offered in the area of biological monitoring of the quality of aquatic and terrestrial ecosystems.

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Members of the Research Group

- Dr Ester Popović, full professor
- Dr Desanka Kostić, assistant professor
- Olivera Bjelić-Čabrilo, MS, teaching assistant

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Equipment

Microscope Carl Zeiss Primo Star was acquired in the frame of the Provincial project "Integral control of mosquitoes in protected natural assets (Monitoring of the biodiversity of fish, amphibians and birds in special natural resorts Koviljsko-Petrovaradinski rit and Stari Begej-Carska bara)", 2006-2008.

LEADING OF PROJECTS

- **Survival of the plant and animal world in aquatic ecosystems of Novi Sad**
  Project was financed by the City Government – Secretariat for Urbanism, City Works and Environment, Novi Sad.
  Period: 1999-2001.
  Project Leaders: Prof. Mirjana Vučković and Prof. Ester Popović, Faculty of Sciences, Novi Sad
- **Monitoring of the biodiversity of fish, amphibians and birds in special natural resorts Koviljsko-Petrovaradinski rit and Stari Begej-Carska bara**
  Project was financed by the Provincial Secretariat for Environmental Protection and Sustainable Development.
  Period: 2006-2008.
  Project Leader: Prof. Ester Popović, Faculty of Sciences, Novi Sad.

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PARTICIPATION IN PROJECTS

- **Assessment of the Selected POPs, (PCBs, PCDD/Ps, POCPs) in the Atmosphere and Water Ecosystems from Wastematerials Generated by Warfare in Area of Former Yugoslavia (APOPSBAL) (EU 5th Framework Programme, FP5)**
  Period: 2003-2005
  Project Leader: Prof. Mirjana Vojinović-Miloradov, Department of Chemistry, Faculty of Sciences, Novi Sad.
- **Repopulation of crucian carp (Carassius carassius L.) in fishponds and open waters of Vojvodina (in Serbian)**
  The project was financed by the Provincial Secretariat for Science and Technological Development.
  Period: 2005-2006.
  Project Leader: Prof. Miroslav Ćirković, Faculty of Agriculture, Novi Sad.
- **Effect of biological larvicide based on Bacillus thuringiensis subsp. israelensis on aquatic entomofauna in the protected area of the special natural resort "Stari Begej-Carska Bara", (2006-2007) (in Serbian)**
  The project was financed by the Provincial Secretariat for Science and Technological Development.
  Period: 2006-2007.
  Project Leader: Dr Aleksandra Bočarov-Stančić, Bio-ecological Center, Zrenjanin.
- **Implementation of the Water Frame Directive in the determination of the ecological status of the Jegricka natural park by SERCON method (2008) (in Serbian)**
  The project was financed by the Public Water Management Company of Vojvodina.
  Period: 2008
  Project Leader: Assist. Prof. Snežana Radulović, Faculty of Sciences, Novi Sad.

LABORATORY FOR STUDY AND PROTECTION OF BIODIVERSITY

(Insecta: *Syrphidae* and *Culicidae*)

The research objective of the Group is the advancement of the knowledge about natural heritage of the Balkan Peninsula and its efficient protection. Through the realization of numerous projects it has been possible to establish the samples, directions and degree of the changes in the ecosystems and plan actions that might stop the negative degradation processes. The multidisciplinary studies are concerned with taxonomic analyses of two large groups of insects (*Syrphidae* and *Culicidae*) on the Balkan Peninsula, monitoring of the biodiversity (especially in protected areas), study of endemic species, relicts and endangered species and establishing their genetic varieties, changes in populations, as well as the analysis of general states of the ecosystems in protected areas.

OBJECTIVES

1. Preservation of the biodiversity of the Balkan Peninsula based on the results of scientific investigations
2. Utilization of selected groups of invertebrates as suitable indicators of the changes taking place in the ecosystems due to global changes, as part of biodiversity monitoring
3. Special attention is focused on the investigation of complex interactions between plants and selected groups of invertebrates
4. The effect on practical measures of conservation through providing expertise, proposition of protection of particular biodiversity centers and hotspot areas, and establishment of conservation measures and priorities
5. Supporting sustainable development of communities as a way of biodiversity protection
6. Advanced training of the cadres in the field of conservational biology and their engagement in practical activities of protection
7. Cooperation with other scientific, professional and nongovernmental organizations that are involved in biodiversity preservation

LEADING OF PROJECTS

- **Assessing LArge-scale environmental Risks with tested Methods, (ALARM), FP6, Project No.: GOCE-CT-2003-506675, 2007-2009**
  Project Coordinator on behalf of the University of Novi Sad: Prof. Ante Vujić, Faculty of Sciences
  Partners on the Project: University of Stellenbosch, South Africa; Institute of Cytology and Genetics SB, RAS, Novosibirsk, Russia; V.N. Sukachev Institute of Forest, Siberian Branch, RAS, Krasnoyarsk, Russia; El Colegio de la Frontera Sur, Tapachula, Mexico; Institute of Biology of the

Members of the Research Group

- Dr Smiljka Šimić, full professor
- Dr Ante Vujić, full professor
- Dr Snežana Radenković, assistant professor
- Dubravka Polić, MS, junior researcher
- Zorica Nedeljković, MS, PhD student
- Sanja Veselić, junior researcher
- Ana Stefanović, junior researcher
- Andrijana Andrić, BS – master
- Dušanka Krašić, junior researcher
- Marija Knežević, junior researcher

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Equipment

Laboratory of Entomology (the latest acquired equipment): Binocular Stereoscopic microscope TWISTER-Z, CETI, two instruments; Automatic dry ice traps for monitoring adult mosquitoes population

Some team members and students engaged on the projects (from left to right): Sanja Veselić, Ivana Dragičević, Ante Vujić, Ana Stefanović, Ljubomir Pejčić

Southern Seas, Odessa Branch, Ukraine; Institute of Zoology, National Academy of Sciences, Minsk, Republic of Belarus; Institute for Biological Research „Siniša Stanković", University of Belgrade, Serbia; Institute of Zoology, Chinese Academy of Sciences, Beijing, China; Universidad Mayorde de San Andres, La Paz, Bolivia; Latin American Faculty of Social Sciences, Guatemala; International Rice Research Institute, Los Banos, Philippines.

Project description, activities and aims: Assessment of the effect of climatological changes, biological invasions, loss of pollinators and chemical agents on the state of the environment, and in the context of soil utilization by man. To this end a FSN (Field Site Network) was established in 35 countries. In Serbia, this was done in the frame of two FSN areas (Grabovo and Beočin).

- **A science based approach to understand biodiversity driven functions and services for improving wetland management (BioWetMan), Austrian Science and Research Liaison Office (ASO); Multilateral project, Project No.: ASO-4-25-2008, 2008-2009**

  The project was financed by ASO - Austrian Science and Research Liaison.

  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad

  Partners on the Project: Wasserkluster Lunz – Biologische Station GmbH, Austria; Bulgarian Academy of Sciences, Institute of Zoology; Croatia-Department of Biology, University of Osijek; Institute of Biology Bucharest, Romania.

  Project description, activities, goals: Scientific approach to a better understanding of the biodiversity function and role with the aim of improving management of humid areas. Activities were undertaken in several working groups engaged on topography, hydrology, vegetation, invertebrates, vertebrates, ecosystem function, index of photosynthetic activity and phytoplankton, macrophytes.

MONOGRAPH OF THE NATIONAL IMPORTANCE

Šimić, S., Vujić, A., Radenković, S., Radišić, P. (2008). Hoverflies (Insecta: *Diptera: Syrphidae*) of the Fruška Gora mountain. – In: Invertebrates (Invertebrata) of the Fruška Gora mountain, Department of Natural Sciences of Matica Srpska.

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6. Milankov, V., Stamenkovic, J., Vujić, A. (2007). Genetic differentiation and linkage disequilibrium in a spatially fragmented population of Cheilosia vernalis (*Diptera: Syrphidae*) from the Balkan Peninsula, *Acta Zoologica Academiae Scientiarum Hungaricae*. 53: 193- 201.
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9. Vujić, A., Perez-Banon, C., Radenković, S., Ståhls, G., Rojo, S., Petanidou, T., Šimić, S. (2007). Two new species of genus Merodon Meigen, 1803 (*Syrphidae, Diptera*) from the island of Lesvos (Greece), in the eastern Mediterranean, *Annales de la Societe Entomologique de France*. 43(3): 319-326.
10. Vujić, A., Radenković, S., Polić, D. (2008). A review of the luteitarsis group of the genus Pipiza Fallén (*Diptera: Syrphidae*) with description of a new species from the Balkan Peninsula. *Zootaxa* 1845: 33- 46.
11. Vujić, A., Stahls, G., Rojo, S., Radenković, S., Šimić, S. (2008). Systematics and phylogeny of the tribe Paragini based on molecular and morphological characters. *Zoological Journal of the Linnean Society*. 152(3): 507- 536.

- **The Course Development Plus Program Grant: Conservation Biology, WUS, Project No.: CDP+NO.116/06, 2007**
  Project was financed by WUS Austria.
  Project Coordinators: Prof. Ante Vujić and Prof. Vesna Milankov
  Project description, activities, and goals: Equipment was procured for the Laboratory and realization of teaching, as well as the pertinent literature and lecture notes were prepared.
- **Preservation of biodiversity in the diversity centers („Hot Spots") of the Balkan and Iberian peninsulas (Insecta: *Diptera: Syrphidae*); the program of importance for science and technological development of AP Vojvodina, Project No.: 114-451-00566/2007-01, 2005-2008**
  The project was financed by the Provincial Secretariat for Science and Technological Development of AP Vojvodina.
  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad
  Partners on the Project: University of Helsinki, Zoological Museum, Finland; University of Alicante, Spain; National Museum of Scotland, Edinburgh, UK; University of Aegean, Department of Geography, Mytilene; Museum of Natural Sciences of FYR Macedonia, Skopje; Europe Invertebrate Survey, The Netherlands.
  Project decryption, activities, goals: Monitoring of the biodiversity and valorization of the state in the diversity centers, with a special emphasis on „hot spots" of the regions (on the Balkan Peninsula these are the Pannonian mountains, and woody areas, gorges and canyons, Mediter-

Dry ice trap

ranean belt). Detection of endemic species, relicts, rare and endangered species with the aim of their more efficient protection. Genetic analysis of natural populations and analysis from the aspect of the principle of conservation biology. The financial resources obtained were dedicated for research, traveling, purchase of materials and equipment.

- **Marshes of Vojvodina – yesterday, today, tomorrow; Republic program; Fundamental research, Project No.: 401-00-46/2007-03, 2005-2009**
  Project is financed by Matica Srpska, Novi Sad.
  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad
  Project description, activities, goals: Study of the marshes along large rivers in Vojvodina, investigation of their main characteristics and succession processes taking place in them; complex investigations encompass a number of scientific disciplines with the aim of getting insight into the physico-chemical, geographical and biological characteristics of these habitats.
- **Regulation of population density of mosquitoes (*Diptera: Culicidae*) in protected natural zones (II degree of protection) in 2008. The Provincial Secretariat for Environmental protection and Sustainable Development, Program of importance for science and technological development of AP Vojvodina; Project No.: 119-401-03560/2008; 2007-2009**
  The project was financed by the Provincial Secretariat for Environmental Protection and Sustainable Development.
  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad
  Project description, activities, goals: The activities are aimed at finding most effective predators of mosquito larvae in the marshes of Vojvodina, exclusively native in this region, as the means of biological control of these insects.
- **Monitoring of the population of adult mosquitoes (*Diptera: Culicidae*) in AP Vojvodina. Provincial Secretariat for Environmental Protection and Sustainable Development, the Program of importance for science and technological development of AP Vojvodina; Project No.: 119-401-03561/2008. Project duration: 2007-2009**
  The project was financed by the Provincial Secretariat for Environmental Protection and Sustainable Development.
  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad
  Project description, activities, goals: The activities within the project encompass regular monitoring of the population of adult mosquitoes on the territory of Vojvodina, on the overall 80 measuring spots.

PARTICIPATION IN PROJECTS

- **Plant louses, parasitic wasps and eriophyid mites: diversity and phylogenetic relations; Republic program of fundamental research, Project No.: 143006B, 2006-2010.**
  The project is financed by the Ministry of Science and Technological Development of the Republic of Serbia
  Project Coordinator: Prof. Željko Tomanović, Faculty of Biology, University of Belgrade.
  Project description, activities, goals: In the two-year period, 15 new taxons have been detected, many of which are important from the aspect of biological control of insect and weed species harmful to the national economy. Some of these taxons are endemic for Serbia and Balkan Peninsula. Clues for identification of a number of taxons have been published.

Binocular magnifying glass

Entomological box

LABORATORY FOR EVOLUTIONARY BIOLOGY

Members of the Research Group

- Dr Vesna Milankov, associate professor
- Dr Jasmina Ludoški, assistant professor
- Ljubinka Francuski, PhD student

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Cooperation

- Finnish Museum of Natural History, University of Helsinki, Finland
- Instituto Universitario de la Biodiversidad CIBIO – Universidad de Alicante, Spain

Equipment

- Equipment for extraction and amplification (PCR) DNA, acrylamide and agarose gel for electrophoresis (several apparata) and visualization: Mastercycler personal, Ependorf; Centrifuge 5415 R, w/o rotor with cooling, Ependorf; Thermomixer compact, Ependorf, (CDP+, WUS Austria "Support to University Education in Serbia and Montenegro 2005/2007); System Sub-Cell for agarose gel electrophoresis, Bio-Rad; and acrylamide gel electrophoresis Hoefer SE 600, Pharmacia Biotech; AC/DC transformer EPS 3500, Pharmacia Biotech.

Systems for DNA and protein electrophoresis

In the Laboratory for Evolution (Laboratory for Evolutionary Systematics and Taxonomy - LEST) use is made of molecular and phenotype characters to study genetic and taxonomic diversity and history of life forms, especially of insects of the families *Syrphidae* and *Culicidae*. The research interest includes systematics phylogeny and speciation of various groups, especially taxons from the Balkan and Iberian peninsulas and Northern Europe, as well as conservation genetics of endemic, rare and spatially fragmented taxons. The main research objects are allozyme loci, mitochondrial and nuclear genes, as well as geometrical morphometry of wings.

Europe, and especially the Balkan Peninsula, are the regions known for their richness of endemic groups of animals and plants. The cycles of areal contraction and expansion during the Pleistocene played an important role in forming of high taxonomic, phenotypic and genetic diversity on the Balkans. Studies of species population fragmentation in space and time offers an insight into the microevolutionary processes that occurred in the history of species. Hence, assuming an integrative approach, the research interests of the LEST can be defined as follows:

1. Study of the genetic and taxonomic diversity. The LEST uses efficiently protein electrophoresis, DNA sequencing, and geometric morphometry in solving taxonomic problems of selected groups of species, determining the boundaries between species and defining divergent phenotype units. The data obtained in the laboratory work contribute to the discovery of concealed phenotypic and genetic units and evolutionary diversification of analyzed taxons.
2. The use of various molecular and nuclear markers of nuclear and mitochondrial genes in combination with morphological characters allows quantification of intra- and interpopulational variability of taxons, mainly of insects of the families *Syrphidae* and *Culicidae*. The registered phenotypic diversity and established cryptic species originated from the Balkan Peninsula indicate the complexity of the biogeographic and evolutionary history of populations, accompanied by passing through the bottleneck and by expansion. Hence, the registered distribution of the phenotypic and molecular diversity (genetic, species, and ecosystem diversity) and processes involved in its origin, forming and maintenance.
3. The MtDNA, nDNA sequences, allozyme loci and geometrical morphometry of wings are also successfully used in studying phylogeny and genetic kindredness of the groups of species.

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2. Francuski, Lj., Vujić, A., Kovačević, A., Ludoški J., Milankov, V. Identification of the species of the *Cheilosia variabilis* group (*Diptera, Syrphidae*) on the Balkan Peninsula using wing geometric morphometrics with the

Equipment for DNA amplification - Mastercycler personal

revision of status of C. melanopa redi Vujić, 1996. *Contributions to Zoology*. (in press)
3. Milankov, V., Ludoški, J., Ståhls, G., Stamenković, J., Vujić, A. (2009) High molecular and phenotypic diversity in the *Merodon avidus* complex (*Diptera, Syrphidae*): cryptic speciation in a diverse insect taxon. *Zoological Journal of the Linnean Society*, 155: 819-833.
4. Milankov, V., Ståhls, G., Vujić, A. (2008) Molecular diversity of populations of the *Merodon ruficornis* group (*Diptera, Syrphidae*) on the Balkan Peninsula. *Journal of Zoological Systematics and Evolutionary Research*, 46(2): 143-152.
5. Ståhls, G, Vujić, A., Milankov, V. (2008) *Cheilosia vernalis*-complex: molecular and morphological variability (*Diptera, Syrphidae*). *Annales Zoologici Fennici,* 45(2): 149-159.
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7. Ludoški J., Francuski, Lj., Vujić, A., Milankov, V. (2008) The *Cheilosia canicularis* group (*Diptera: Syrphidae*): species delimitation and evolutionary relationships based on wing geometric morphometrics. *Zootaxa*, 1825: 40-50.
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9. Milankov, V., Stamenković, J., Vujić, A (2007) Linkage disequilibrium and genetic differentiation in a spatially fragmented population of *Cheilosia vernalis* (*Diptera: Syrphidae*) from the Balkan Peninsula. *Acta Zoologica Academiae Scientarum Hungaricae*, 53(2): 193-201.
10. Milankov, V., Stamenković, J., Ludoški, J., Ståhls, G., Vujić, A. (2005) Diagnostic molecular markers and genetic relationships among three species from the *Cheilosia canicularis* group (*Diptera: Syrphidae*). *European Journal of Entomology*, 102: 125-131.
11. Milankov, V., Vapa, Lj., Petrić, D. (2000) Genetic markers for the identification of Aedes caspius (Pallas, 1771) and *Aedes dorsalis* (Meigen, 1830) (*Diptera: Culicidae*). *Biological Journal of the Linnean Society,* 71: 53-60.

- Equipment for geometric morphometry Leica MZ 12.5 Stereomicroscope, Leica 320DFC camera (Kit, PC and Mac), Leica LAS software package (CDP+, WUS Austria "Support to University Education in Serbia and Montenegro 2005/2007").

PARTICIPATION IN PROJECTS

- **Assessing LArge scale Risks for biodiversity with tested Methods (ALARM)**
  GOCE-CT-2003506675; sub-priority 6.3; (www.alramproject.net/alarm/)
  The project was financed in the frame of the Sixth Framework Programme (FP6) of the EU.
  Local Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad.
- **Marshes of Vojvodina – yesterday, today, tomorrow**
  The project is financed by Matica Srpska, Novi Sad, since 2006.
  Project leader: Prof. Ante Vujić, Faculty of Sciences, Novi Sad.
- **Plant louses, parasitic wasps and eriophyid mites: diversity and phylogenetic relations; Republic program of fundamental research, Project No.: 143006B, 2006-2010**
  The project is financed by the Ministry of Science and Technological Development of the Republic of Serbia
  Project Coordinator: Prof. Željko Tomanović, Faculty of Biology, University of Belgrade.
- **Preservation of biodiversity in the diversity centers ("Hot Spots") of the Balkan and Iberian peninsulas (Insects: Diptera: Syrphidae); the program of importance for science and technological development of AP Vojvodina, Project No.: 114-451-00566/2007-01, 2005-2008.**
  The project was financed by the Provincial Secretariat for Science and Technological Development of AP Vojvodina.
  Project Coordinator: Prof. Ante Vujić, Faculty of Sciences, Novi Sad

LABORATORY FOR PALEOENVIRONMENTAL RECONSTRUCTION

LAPER

Members of the Research Group

- Dr Zorica Svirčev, full professor
- Dr Slobodan Marković, associate professor
- Dr Ružica Igić, full professor
- Dr Gordana-Grubor Lajšić, full professor
- Dr Aleksandar Djordjević, full professor
- Dr Arpad Takači, full professor
- Dr Dušanka Perišić, full professor
- Dr Nenad Teofanov, full professor
- Dr Snežana Radulović, assistant professor
- Dr Dragana Vukov, assistant professor
- Dr Srdjan Rončević, assistant professor
- Jelica Simeunović, MS, teaching assistant
- Maja Karaman, MS, teaching assistant
- Danijela Kojić, MS, teaching assistant
- Jelena Purać, MS, teaching assistant
- Biljana Basarin, MS, junior researcher
- Jelena Tričković, MS, teaching assistant
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LABORATORY FOR PALEOECOLOGICAL RECONSTRUCTION (LAPER)

The Laboratory for Paleoecological Reconstruction (LAPER) was founded at the beginning of 2009 with the objective to achieve better organization of the work of individuals and groups from the Faculty engaged on the research in this area, more active association with similar institutions in the world, and expanding the activities in accordance with research, financial and other interests and strategy of the development of the Faculty of Sciences.

The LAPER founders and associates are gathered around the common idea of analyzing as large as possible number of biological and biochemical indicators as biomarkers in the reconstruction of the environmental and climatic conditions of the past.

The Laboratory provides facilities for investigation of the following biological, chemical, and biochemical indicators in the paleoecological and paleoclimatological reconstruction:

- Pollen
- Malacological investigations
- Silicate algae
- Nonstandard palynomorphs
- Hydrocarbon, lipid, and other chemical biomarkers
- C:N ratio
- New biochemical indicators based on the analyses of recent extremophilic and cultivated microbes
- Mathematical modeling
- Paleoecological and paleoclimatological reconstruction

Thanking to the capacity to perform the above analyses, the LAPER is also qualified to perform the following activities of research and service type:

1. Analysis of lake sediments with the aim of sanation and conservation of standing aquatic ecosystems by paleolimnological techniques,
2. Analysis of terrestrical sediments with the aim of the appropriate recultivation of damaged and degraded soils,
3. Evaluation of paleoecological and paleoclimatological archives from the aspect of identification and appropriate protection of geological heritage,
4. Analysis of paleoclimatic changes by studying the loess, fluvial and glacial sediments,
5. Reconstruction of potential vegetation with a special emphasis on dating the occurrence of some allergic and allochthnous plant species important to man,
6. Reconstruction and quantification of pedogenetic processes in the recent and paleo-soils.
7. Analysis of recent autochthonous extremophilic and cultivated microorganisms originated from the soil crust with the aim of finding new bioproxies and reconstruction of extremal paleoecological and paleoclima-

tological conditions and changes, as well as the assessment of the role of soil crust in forming of Eolian and loess deposits,
8. Recognizing the possibility of utilization of actual and new biomarkers in astrobiological investigations.

The previous investigations of the Laboratory members in the sense of joint participation in the preparation of projects and publishing scientific papers is time limited because of the fact that the Laboratory was founded only at the beginning of 2009.

CURRENT ACTIVITIES

1. Formation of the collection of cyanobaceteria cultures and of the Database of the collection of cultures of microorganisms for the Ministry of Environmental Protection as the Novi Sad Cyanobacteria Culture Collection (NSCCC) and collection of specimens of soil crust;
2. Organization of scientific meetings (Loessfest 2009);
3. Organization of field research of loess-paleosoil sediments;
4. Organization of research expeditions in the country and abroad with the aim of providing representative samples and necessary information for complex study of selected paleoecological and paleoclimatic archives;
5. Organization of topical meetings, seminars, workshops and training courses for gaining modern knowledge;
6. Participation in the preparation of the project proposal for COST fund (ESSEM domain) in the action entitled Upgrading New Indicators for Palaeo-Environmental Reconstruction (UNIPER), for the period 2009-2013, under heading of a partner from Germany;
7. Preparation of advertising material and web pages for informing community and offering services and expertise.

Based on the existing space and equipment of the departments of the Faculty of Sciences, the Laboratory is fully equipped for the investigations envisaged in the current and planned projects, as well as for providing services to the third parties.

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Members of the Research Group

- Dr Zorica Svirčev, full professor
- Dr Branko Miljanović, assistant professor
- Dr Desanka Kostić, assistant professor
- Sonja Pogrmić, junior researcher
- Ivana Mijić, BS (Ecology)
- Students engaged in the Team: Šandor Šipoš, Nemanja Pankov and Tamara Dulić.

HYDROBIOLOGY

The Group for Hydrobiology has a tradition longer than 35 years. Its research interests are concerned with the assessment of water quality of freshwater ecosystems, assessment of biodiversity and providing services in the area of aquaculture.

Cooperation has been established with the Water Institute from Bijeljina, Republic of Srpska; Waterworks of Banja Luka, Republic of Srpska; Institute of Animal Breeding "Cyril and Methodius" from Skopje, FYR Macedonia; Institute "Jaroslav Černi", Belgrade; Public Water Management Company "Vode Vojvodine", Novi Sad; waterworks in Leskovac, Aleksinac, Soko Banja, Temerin; Fisherman's Union of Vojvodina, as well as with many other unions of sport fishermen. There exists a long-standing active cooperation with the fishponds "Ečka", "Bečej", "Kapetanski rit", DTD "Fishery" from Petrovaradin, etc. Excellent cooperation has also been established with the DP "Zobnatica" from Backa Topola and DP "Krivaja" from Krivaja.

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Members

The Center is headed by the Council, an expert body, whose members are:

- Prof. Emeritus Leposava Šidjanin, Faculty of Technical Sciences, Novi Sad, Leader of the Center
- Prof. Jonjaua Ranogajec, Faculty of Technology, Novi Sad
- Prof. Vladimir Srdić, Faculty of Technology, Novi Sad
- Prof. Srdjan Rakić, Faculty of Sciences, Novi Sad
- Prof. Milica Matavulj, Faculty of Sciences, Novi Sad
- Miloš T. Bokorov, BS (Biology), Head of the Center, Faculty of Sciences, Novi Sad

UNIVERSITY CENTER FOR ELECTRON MICROSCOPY NOVI SAD (UCEM-NS)

The University Center for Electron Microscopy (UCEM-NS) originated from the Laboratory for electron microscopy (LEM) at the Faculty of Sciences, founded in 1979.

The aim was to procure two excellent electron microscopes of the world producer from Japan, JEOL–JSM 35 and JEE-100C, primarily for the researchers from the University of Novi Sad, and then for a wider research population, to use top quality electron microscopy instruments. The instruments, both scanning and transmission electron microscope and the corresponding photolaboratory, have been intended for general use, to cover a wide field of research, from biomedical sciences to the studies in the field of materials science in a widest sense. The policy of the LEM was based on the openness, general and free access to researchers, which is closest to the principle of the work of the centers for electron microscopy at the world universities. And exactly this has enabled the foundation and development of electron microscopy at the University of Novi Sad, and also contributed to its development in Serbia.

The work and interests of researchers from the whole former Yugoslavia of that time has brought the fame to LEM and Faculty of Sciences, which was primarily seen from the fact that the more than one half of the works presented at the meetings from electron microscopy came out just from this laboratory.

After almost one quarter of a century of experience and cooperation with numerous research centers in the country and in the region, the purchase of the instruments of the new generation (digitalized scanning microscope JEOL JSM 6460 LV and capital equipment for the needs of the University of Novi Sad by the Ministry of Science of the Republic of Serbia), the LEM was promoted into the UCEM-NS, confirming formally the principle of openness and accessibility.

EQUIPMENT

The equipment and professional support make it possible to do research related to morphological and structural characterization of diverse solid materials to the level of nano structure in fundamental and engineering investigations (metallurgy, polymers, ceramics, catalysts, electro-materials, textile, geological materials, archeological materials, etc.), biomedical investigations with morphological determination, as well as micro-chemical characterization up to the level of several tenths of micrometer (microbiology, botanics, zoology, veterinary medicine, normal and pathological medicine, ecological and ecotoxicological studies, forensics, and food technology of milk, bread, etc.).

JEOL JSM 6460 LV scanning microscope, together with the EDS device Oxford INCA – Digitalized instrument of the resolution of 3-4 nanometers,

magnifies in the range from 8 to 300,000 times and enables work in the range from high vacuum to environment levels, SEI, BEI topo, compo, shadow.

JEOL – JSM 35 scanning electron microscope (with film recording) – Analogue device of the resolution of 7-8 nanometers, magnification in the range of 10 – 180,000 times.

JEOL – JEM-100C transmission electron microscope (with film recording). Analogue device of the resolution of 3-4 nanometers, magnification up to 300,000 times.

BAL-TEC, SCD 005 SPUTTER COATER – Vacuum device for sample preparation by gold sputtering or carbon evaporation.

JEOL –JEE-4B vacuum evaporator – Vacuum device for the preparation of samples on the rotating table and system of evaporation of carbon or metals.

LKB-ULTRATOME – NOVA, ULTRAMICROTOME for sample preparation using ultrasound and ultra thin slicing for transmission microscopy.

DURST and KROKUS with Schneider optics – device for magnifying photonegatives and the belonging photolaboratory equipment.

The Center provides services to the researchers from the University of Novi Sad: the parent Faculty of Science – Departments of Biology, Chemistry and Physics; Faculty of Technical Sciences; Faculty of Technology; Faculty of Agriculture; Faculty of Medicine – all for the needs of the Republic, Provincial, and European projects on which work researchers from the mentioned faculties; researchers from the University of Belgrade and scientific institutes: Faculty of Technology and Metallurgy; Institute of Chemistry, Technology and Metallurgy; Institute for Technology of Nuclear and other Materials; Faculty of Physical Chemistry; Biological Faculty; Serbian Academy of Sciences and Arts; Vinca Nuclear Institute; Faculty of Agriculture; Faculty of Pharmacy; Faculty of Mining and Geology; Faculty of Veterinary Medicine; Faculty of Dentistry; National Museum; Nikola Tesla Institute, etc.

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PLASMA PHYSICS

The main research activities of the Group are concerned with optical diagnostics of plasma and broadening of spectral lines in plasma and study of solar UV radiation and UV radiation from artificial sources.

LEADING OF PROJECTS

- **Monitoring of Ultraviolet (UV) Radiation**
  (WUS CEP 95/2002); World University Service, Austria.
  Project Duration: 2002.
  Project Leader: Prof. Zoran Mijatović, Faculty of Sciences, Novi Sad.
- **Spectral characteristics of plasma radiation, time development and characteristics of the plasma source**
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project Duration: 2006 – 2010
  Project Leader: Prof. Stevica Djurović, Faculty of Sciences, Novi Sad.
- **Fundamental characteristics and application of radiofrequency gas discharges**
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project Duration: 1994-1999
  Project Leader: Prof. Stevica Djurović, Faculty of Sciences, Novi Sad.
- **Monitoring and forecasting of UV index on the territory of Novi Sad**
  City Authorities for Environmental Protection, City of Novi Sad.
  Project Duration: 2003-2009
  Project Leader: Prof. Zoran Mijatović, Faculty of Sciences, Novi Sad.
- **Monitoring of UV radiation**
  Provincial Secretariat for Environmental Protection and Sustainable Development.
  Project Duration: 2002-2003
  Project Leader: Prof. Zoran Mijatović, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Reinforcement of the Research Potential in Center for Meteorology and Environmental Predictions, (FP6 – RRP-CMEP)**
  Financed from the Sixth Framework Programme (FP6) of European Union.
  Project Duration: 2007 – 2009
  Project Coordinator: Prof. Dragutin T Mihailović, Head of CMEP, Faculty of Sciences, Novi Sad.
  Prof. Zoran Mijatović, Faculty of Sciences, Novi Sad, also participates in the project.

Members of the Research Group

- Dr Zoran Mijatović, full professor
- Dr Božidar Vujičić, full professor
- Dr Stevica Djurović, full professor
- Dr Radomir Kobilarov, full professor
- Dr Igor Savić, assistant professor
- Teodora Gajo, junior researcher
- Nataša Antonijević, associate
- Zoltan Nađ, professional associate

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Cooperation

Cooperation with other institutions and companies has been established in the following areas:

- Spectral properties of filters (JUGODENT, Novi Sad, 1983)
- Manufacture of surgical lasers (in cooperation with the Institute of Physics, Zemun), (JUGODENT, Novi Sad, 1986)
- Physical characteristics of antifreeze (IMPULS HEMIJA, Novi Sad, 2003 – 2005).
- Design and manufacture of magnets for studying the influence of magnetic field on living organisms (FACULTY OF MEDICINE, Novi Sad, 1982 – 1986)
- Consulting services related to installing a laser system for manufacturing matrices for wire drawing (NOVKABEL, Novi Sad, 1985)
- Quality of high-voltage capacitors (MINEL, Ripanj, 1983)
- Absorption properties of the materials used for UV radiation protection creams (MILITARY MEDICAL ACADEMY, Belgrade, 2005)

It is planned to establish cooperation with industrial companies from the field of the effect of UV radiation on various materials (dyes, textile), as well as the effect of UV radiation on various organisms.

Spectroscopy system: ICCD camera and monochromator

- **Measurement of the regularity of atomic Stark parameters of np-nd transitions for the series of homologue noble gases**
  (Medida de regularidades atomicas de parametros Stark de l transiciones np-nd en la serie homologa de los gases nobles ionizados);
  Project Coordinator: Prof. Santiago Mar, Faculty of Sciences, University of Valladolid, Spain.
- **Plasma and Discharge:**
  Radiation properties and interaction with surfaces;
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project Duration: 2001 – 2005
  Project Leader: Prof. Nikola Konjević, Faculty of Physics, Belgrade.
- **Plasma Spectroscopy**
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project Duration: 1996 – 2000
  Project Coordinator: Prof. Jagoš Purić, Faculty of Physics, Belgrade.
- **Diagnostics of Laboratory and Astrophysical Plasma**
  Ministry of Science and Technological Development of the Republic of Serbia.
  Project Duration: 1994 – 1999
  Project Coordinator: Prof. Nikola Konjević, Faculty of Physics, Belgrade.

EQUIPMENT

- Optical system for plasma spectroscopy (two 1-m monochromators diffraction grids with 1200 lines/mm; fast ICCD camera, photomultipliers)
- Digital oscilloscopes
- Vacuum systems
- High-voltage electric pulse generator
- Simulator of solar UV spectrum with changeable output intensity (FP6 - Reinforcement of the Research Potential in Center for Meteorology and Environmental Predictions)
- Equipment for measuring ozone layer thickness (FP6 - Reinforcement of the Research Potential in Center for Meteorology and Environmental Predictions)

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EXPERIMENTAL PHYSICS OF CONDENSED MATTER

Activities of the Chair of Experimental Physics of Condensed Matter are primarily concerned with studying new materials from the group of amorphous semiconducting systems and nanostructural materials. Special attention is paid to the preparation and optimization of technological procedures of their synthesis. Also, of special concern are the studies that should demonstrate the possibilities of application of amorphous chalcogenides, thin films and nanostructural materials, aiming at the preparation of samples with predefined characteristics. In parallel with this, the Group is also involved in the investigations of some other types of both crystalline and non-crystalline structures, using modern methods of thermal, magnetic and optical measurements, first of all for the research purpose but also for the needs of the building, ceramic and machine industries.

LEADING OF PROJECTS

- **Amorphous and nanostructural chalcogenides**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: 141026; Project Duration: 2006-2010
  Project Leader: Prof. Svetlana Lukić-Petrović, Faculty of Sciences, Novi Sad.
  Apart from the Group from the Faculty of Sciences, a number of associates from the Faculty of Technical Sciences, Novi Sad, Vinca Institute of Nuclear Sciences, and Technical College from Novi Sad, are also engaged on the project.
  The main objective of these investigations is the preparation and full characterization of new materials of relatively complex amorphous systems consisting of chalcogenides and rare earths, as well as nanostructural luminescence systems. The analyses encompass glassy chalcogenide materials and ferroceramics in the form of bulk samples containing apart from sulfur, selenium and/or tellurium, some of the following elements: copper, germanium, arsenic, antimony, iron, iodine, cadmium and erbium, along with the phenomena related to some thin films of the analogous composition. Studies of nanostractural ceramics are focused on some fundamental phenomena of these materials prepared by different processing procedures with the aim of obtaining new ceramic materials with specific properties.
- **Preparation technology and characterization of amorphous semiconductors**
  Project No.: № 114-451-00694, Provincial Secretariat for Science and Technological Development of AP Vojvodina; International/interregional project. Duration: 2005 -2010
  Project Leader: Prof. Svetlana Lukić-Petrović, Faculty of Sciences, Novi Sad.
  The project is realized in cooperation with the Faculty of Technical Sciences, Novi Sad and National Institute of Materials from Bucharest, Romania.
  The main objective of these investigations is to find the most suitable technological process of preparation of complex non-crystalline semiconducting systems with predefined optical, electrical, thermal, and mechanical parameters.

Members of the Research Group

- Dr Dragoslav Petrović, full professor
- Dr Svetlana Lukić-Petrović, full professor
- Dr Mira Terzić, full professor
- Dr Imre Gut, associate professor
- Dr Fedor Skuban, assistant professor
- Goran Štrbac, MS, research associate
- Mirjana Šiljegović, MS. research associate
- Ljubica Djačanin, junior researcher
- Radenko Kisić, professional associate
- Kristina Čajko, junior researcher
- Lazar Beljanski, senior technician
- Branislav Šešum, senior technician

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Cooperation

The Group has a long-standing successful cooperation with several very important institutions in the country and from abroad. Joint research has been carried out with the corresponding teams from the Vinca Institute of Nuclear Sciences, Institute of Physics in Zemun, Faculty of Physics, Faculty of Electrical Engineering, Faculty of Technology and Metallurgy from Belgrade, Faculty of Technical Sciences and Faculty of Technology from Novi Sad, as well as with the Faculty of Electrical Engineering from Niš.
Direct cooperation has also been established with the following institutions from Europe: Departamento de Fisica de la Materia Condensada, Facultad de Ciencias, Universidad de Cadiz, Spain; St. Petersburg State University, Petersburg, Russia; Department of Solid State Electronics, Uzhgorod National University, Ukraine; National Institute of Materials Physics, Bucharest, Romania. Especially important and successful is the cooperation with the Department of Physics of the India Institute of Technology, Guwahati, India.

- **Amorphous and nanostructural chalcogenides and ceramics**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: ON101812. Duration: 2001–2005
  Project Leader: Prof. Dragoslav Petrović, Faculty of Sciences, Novi Sad.
- **Experimental and theoretical studies of physical properties and structure of metals, semiconductors and insulators**
  Republic Program, Fundamental Research (1990–1995); Project No.: E-0127.
  Project Leader: Prof. Dragoslav Petrović, Faculty of Sciences, Novi Sad.
- **Physical characteristics of materials and transport processes**
  Program of importance for science and technological development of AP Vojvodina (1996-2001.); Project No.: 01E18.
  Project Leader: Prof. Dragoslav Petrović, Faculty of Sciences, Novi Sad.
- **In search for nonconventional alternative energy sources**
  Program of importance for science and technological development of APV.

EQUIPMENT

- DSC 822-e METTLER TOLEDO instrument for differential scanning calorimetry
- TMA-7 PERKIN ELMER thermomechanical analyzer
- DERIVATOGRAPH 1000 Paulik-Paulik-Erdey – instrument for simultaneous differential thermal analysis
- LAMBDA 950 UV/VIS SPECTROMETER PERKIN ELMER spectrometer for UV-vis radiation
- HM 2000 FISCHERSCOPE device for testing microhardness of materials
- OCEAN OPTICS MMS RAMAN SPECTROMETAR purchased from the fund of the project 141026 "Amorphous and Nanostructured Chalcogenides", Ministry of Science and Technological Development of the Republic of Serbia
- OCEAN OPTICS QE65000 spectrographic system for recording fluorescence, photoluminescence, and transparence of liquid and solid samples in the UV-vis-NIR region at room temperature.
- CARL ZEISS AXIOSKOP 40 A POL polarization microscope for observing preparations in the reflection and transparence modes, as well as for orthoscopic and conoscopic analyses.

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Members of the Research Group

- Dr Ištvan Bikit, full professor
- Dr Ivan Aničin, full professor
- Dr Miroslav Vesković, full professor
- Dr Jaroslav Slivka, full professor
- Dr Miodrag Krmar, associate professor
- Dr Nataša Žikić-Todorović, assistant professor
- Dr Tijana Prodanović, assistant professor
- Dr Dušan Mrdja, assistant professor
- Sofija Forkapić, MS
- Jan Hansman, BS (Physics), technician
- Slavko Todorović, BS (Mech. Eng.), dosimetrist
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Cooperation

The Group has established contacts with a number of renowned scientific centers from nuclear physics:

- CERN - Geneva
- JINR - Dubna (Russia)
- Sussex University, Oxford (UK)
- Dominguez Hills University (USA)
- Alabama University (USA)
- University in Zurich (Switzerland)
- Illinois University in Urbana-Champaign (USA)
- Institute Laue Langevin-Grenoble (France)
- KFKI (Hungary)
- NIST (USA)
- Max Planck (Germany)

NUCLEAR PHYSICS

Studies in the field of Nuclear Physics have a long tradition at the Faculty of Sciences. In the first phase of the development, experimental investigations of the Group members were realized in the Vinca Institute of Nuclear Sciences in Vinca. They used measurement techniques of gamma and beta spectroscopy, coincidence spectroscopy and beta-gamma angular correlations to study nuclear structure. After putting out of action of some bigger nuclear installations at Vinca, experimental research has been mainly carried out in the frame of international cooperation, related primarily to techniques of Mossbauer spectroscopy and nuclear orientation. By combining fundamental investigations with the possibilities of application of nuclear measuring techniques the conditions have been gradually created to do research in Novi Sad, concerning primarily low-background gamma spectrometry, methodology of nuclear spectroscopy and study of rare nuclear processes. The first experimental PhD thesis from nuclear physics (problem of double beta decay) was completed in 2004. In parallel with the development of fundamental research a rounded-up form attained also the services in the area of testing radio purity and radio ecology, so that the Group formed the Laboratory for measuring radioactivity and doses of ionizing and non-ionizing radiation. Beginning from 2006 the Laboratory has been accredited by the JUAT Accreditation body. The Group has gained reputation in the area of control of radioactivity of goods in public circulation.

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Liquid scintillation spectrometer QUANTULUS

Detection system MIREDO

3. Mrda D, Bikit I, Veskovic M, Forkapic S: CONTRIBUTION OF ^{210}Pb BREMSSTRAHLUNG TO THE BACKGROUND OF LEAD SHIELDED GAMMA SPECTROMETERS, *Nuclear Instruments and Methods in Physics Research* A, Vol. 572, str. 739-744, ISSN 0168-9002. (2007)
4. Tijana Prodanović, Brian D. Fields and John F. Beacom: DIFFUSE GAMMA RAYS FROM THE GALACTIC PLANE: PROBING THE „GeV EXCESS" AND IDENTIFYING THE „TeV EXCESS", *The Astroparticle Physics*, 27, 10-20 (2007).
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6. I. Bikit, J. Slivka, D. Mrdja, N. Žikić-Todorović, S. Ćurčić, E. Varga, M. Vesković, Lj. Čonkić: SIMPLE METHOD FOR DEPLETED URANIUM DETERMINATION, *Jpn. J. Appl. Phys.*, No. 42, str. 5269-5273 (2003)

LEADING OF PROJECTS

- **Nuclear Spectroscopy and Rare Processes**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: 141002;
  Duration: 2006 - 2010
  Project Leader: Prof. Ištvan Bikit, Faculty of Sciences, Novi Sad.
  Currently, two gamma spectrometric systems for studying nuclear reactions induced by cosmic muons are under development, viz.: CRYME experiment and MIREDO system, and recently a low-background liquid scintillation alpha-beta spectrometer, Quantulus, has been put into operation, which will allow radioactive dating mainly based on 14C.

- **Adapting Active Protection of the Germanium Spectrometer for Low-energy Region**
  Provincial Secretariat for Science and Technological Development;
  Duration: from 2006
  Project Leader: Prof. Ištvan Bikit, Faculty of Sciences, Novi Sad.
  The work in the frame of the project is concerned with the development of low-background gamma spectrometric system that would enable detection of events induced in different materials under action of secondary radiation generated by muons in the lead protection of the germanium spectrometer.

PARTICIPATION IN PROJECTS

- **EUROpean Nuclear Structure (EURONS), The Sixth Framework Programme (FP6) of the European Union**
  Duration: 2005 – 2010.
  Project Coordinator for Serbia: Prof. Ištvan Bikit, Faculty of Sciences, Novi Sad.
  The Group for Nuclear Physics is a member of the EWON (East-West-Outreach Nuclear Physics Network), EURONS project, which encompasses countries from our region and in the frame of the project it coordinates the development of scientific infrastructure for nuclear physics, as well as the educational development of scientific cadres.

- **Integrated Large Infrastructure for Astroparticle Science (ILIAS), The Sixth Framework Programme (FP6) of the European Union**
  Duration: 2004 – 2009
  Project Coordinator for Serbia: Prof. Miroslav Vesković, Faculty of Sciences, Novi Sad.
  The objective of the ILIAS project is to work out joint strategy for a direct detection of dark matter in the Universe.

Portable gamma spectrometric system

7. I. Bikit, L. Lakosi, J. Sáfár and Lj. Čonkić: DEEXCITATION OF ^{180m}Ta BY ^{60}Co GAMMA-RAYS, *The Astrophysics Journal*, Vol. 522, No. 1, str. 419-423. (1999)
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Spectrometric system CRYME

Fast-slow coincidence system

11. M. Krmar, J. Slivka, I. Bikit, M. Vesković, Lj. Čonkić: EVALUATION OF BREMSSTRAHLUNG SPECTRA GENERATED BY A 4 MeV LINEAR ACCELERATOR, *Medical Physics*, No. 23, str. 651-658 (1996)
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Equipment

Measurements are carried on high-quality measuring instruments:

- Four high-resolution low-background germanium spectrometers of the manufacturers Canberra and Ortec, USA
- Modern software *Genie 2000* for acquisition and analysis of spectra
- Scintillation spectrometer NaI(Tl) with lead protection
- Portable scintillation spectrometer Mini Spec
- Liquid scintillation alpha-beta spectrometer - Quantulus
- 20 digital dosimeters of ionizing radiation of different manufacturers
- He3 neutron dosimeter
- Two instruments for measuring electromagnetic field with the probes of different sensitivity
- BARRACUDA multimeter to control X-ray apparatus
- Portable radon monitor RAD7
- Standard reference sources for calibration
- Equipment for sampling and preparation of samples from the environment (cupboard, desiccators, balances, stirrers, carbon containers, etc.)

Members of the Research Group

- Dr Vladimir Divjaković, full professor
- Dr Agneš Kapor, full professor
- Dr Dušanka Obadović, full professor
- Dr Slobodanka Stanković, full professor
- Dr Jovan Šetrajčić, full professor
- Dr Dušan Lazar, associate professor
- Dr Srdjan Rakić, associate professor
- Dr Sonja Skuban, associate professor
- Dr Željka Cvejić, assistant professor
- Dr Maja Stojanović, assistant professor
- Dr Olivera Klisurić, assistant professor
- Stevan Jankov, junior researcher
- Ljubomir Labus, technical associate
- Slobodan Božić, technical associate
- Sava Božić, technical associate

PHYSICS OF CRYSTALLINE, POLYMERIC AND PARACRYSTALLINE MATERIALS

Experimental investigations are primarily related to X-ray analysis of monocrystalline and polycrystalline materials at room and elevated temperatures, along with dielectric and magnetic measurements. Of special interest are nano ferrites, pharmacologically active materials, then polymers, and liquid crystals.

Researchers from the Group are included in six project financed by the Ministry of Science and Technological Development of the Republic of Serbia. The main research directions are:

- Structural investigations of biologically active and other newly synthesized compounds in solid (crystalline) and liquid phases (Dr Agneš Kapor, Dr Sonja Skuban, Dr Slobodanka Stanković and Dr Olivera Klisurić);
- Physical properties of voluminous and nano-particle magnetic materials based on rare earths and transition metals (Dr Srdjan Rakić, Dr Željka Cvejić, Stevan Jankov);
- Structure of polymers (Dr Vladimir Divjaković);
- Physical characteristics of ferroelectric and cholesteric liquid crystals and catalytic systems (Dr Dušanka Obadović, Dr Dušan Lazar and Dr Maja Stojanović);
- Theoretical studies of the phenomena and properties of condensed matter state, primarily of superconductivity (Dr Jovan Šetrajčić).

In their research, the members of the Group cooperate very intensively with the colleagues from the Vinca Institute of Nuclear Sciences in Belgrade; Faculty of Technology in Novi Sad; Faculty of Technology in Leskovac; University in Innsbruck, Austria; University in Bremen, Germany; Institute of Condensed Matter and Optics of the Hungarian Academy of Sciences; Institute of Physics in Prague, Czech Republic; Kansas Polymer Research Center in Pittsburgh, USA.

PARTICIPATION IN PROJECTS

- **Structure and physical study of liquid crystals**
  Bilateral project of the Serbian Academy of Sciences and Arts and Hungarian Academy of Sciences (2006-2009)
- **Synthesis of nanopowders and preparation of ceramic and nanocomposites for the application in new technologies**
  Ministry of Science and Technological Development of the Republic of Serbia; Fundamental Research; Project No.: 142059.
  Duration: 2006 - 2010
  Project Leader: Prof. Vladimir Srdić, Faculty of Technology, Novi Sad.

Diffractometric system for monocrystals Oxford-Diffraction Xcalibur S

Partners on the Project: Faculty of Technical Sciences and Faculty of Technology, University of Novi Sad; Institute of Multidisciplinary Studies, Belgrade.

- **Synthesis and physico-chemical studies of selected organic compounds of potential pharmacological importance**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: 142052.
  Duration: 2006 – 2010
  Project Leader: Prof. Snežana Zarić, Faculty of Chemistry, Belgrade.
  Partners on the Project: Faculty of Chemistry in Belgrade; Institute of Chemistry, Technology and Metallurgy in Belgrade; Vinca Institute of Nuclear Sciences in Belgrade.
- **Phase transitions and characterization of inorganic and organic systems**
  Ministry of Sciences and Technological Development of the Republic of Serbia; Fundamental Research, Project No,: 141020
  Duration: 2006-2010
  Project Leader: Prof. Mićo Mitrović, Faculty of Physics, Belgrade.
  Partners on the Project: Faculty of Physics, Belgrade; Faculty of Sciences, Kragujevac; Faculty of Dentistry, Belgrade; Institute of Medical Studies, Belgrade.
- **Study of the relationship between reactivity, noncovalent interactions and molecular structure and modeling of chemical systems**
  Ministry of Science and Technological Development of the Republic of Serbia; Fundamental Research; Project No,: 142037
  Duration: 2006 – 2010
  Project Leader: Prof. Snežana Zarić, Faculty of Chemistry, Belgrade.

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Equipment

- Diffractometric systems for monocrystals OXFORD-DIFFRACTION XCALIBUR S with GEMINI unit and unit for sample cooling with liquid nitrogen CRYOJET HT system (90 – 490K).
- High-voltage generator SEIFERT ID3000 with automatic goniometer for powdered samples SEIFERT MZ IV and goniometer for powdered samples PHILIPS PW1050/25
- Weissenberg camera STOE & CIE, Debye-Scherrer cameras, Precession camera, Gandolfi camera
- High-temperature chamber ANTON PAAR HTK2 for powdered samples with vacuum pump EDWARDS.
- Dielectrometer DIELECTRIC ANALYZER 2970 (DEA 2970)

Diffractometric system for powder samples

Partners on the project: Faculty of Chemistry, Belgrade; Vinca Institute of Nuclear Sciences; Institute of Chemistry Technology and Metallurgy, Belgrade.

- **Improvement of physical characteristics of nanostructural materials**
  Ministry of Science and Technological Development of the Republic of Serbia; Fundamental Research, Project No.: 141044
  Duration: 2006 - 2010
  Project Leader: Prof. Vjekoslav Sajfert, Technical Faculty, Zrenjanin.
  Partners on the Project: Technical Faculty, Zrenjanin; Faculty of Technical Sciences, Novi Sad; Criminal Police Academy, Belgrade.

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THEORETICAL PHYSICS

Members of the Research Group

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- Dr Darko Kapor, full professor
- Dr Milica Pavkov-Hrvojević, associate professor
- Milica Rutonjski, MS, junior researcher
- Slobodan Radošević, junior researcher

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Cooperation

The Group has very good cooperation with all known related teams in the country and especially with the Vinca Institute of Nuclear Sciences in Belgrade. International cooperation has been established with the research team of the Laboratory of Theoretical Physics "N. N. Bogolyubov" (Dr N. M. Plakide) of the Joint Institute of Nuclear Research in Dubna (Russia), with the Dr Colde's group from Oxford (Great Britain), as well as with the group from the Faculty of Sciences in Podgorica (Montenegro).

The research area of the Group is theory of condensed matter, more precisely, theoretical study of ferro- and antiferromagnetics and other magnetic systems (thin magnetic films, superlattices, etc.) with complex magnetic lattices. These materials are interesting primarily from the aspect of their application in microelectronics (memory systems), but also because of their close relation to the problem of superconductivity. Previous investigations have also been concerned with nonlinear problems in magnetic systems and molecular crystals, as well as with biophysics.

The planned future investigations will encompass the analysis of magnetic systems of complex structure. First of all they will be focused on concrete structures for which there exist reliable experimental measurements. Here, the word is about strictly correlated systems whose magnetic properties are due to localized spins and which can be described well by the Heisenberg model. In the frame of this model, theoretical studies will encompass the analysis of magnetic properties of concrete structures belonging to the family of cuprites, which are the basis of high-temperature superconductors. Also, the studies will be concerned with magnetic manganese halogenides, for which there exist reliable experimental data. Further, it is planned to begin study of magnetic semiconductors. One PhD and one MS theses are currently being in their final stage. The title of the project in the frame of which the present research activities are carried out is: "THEORETICAL STUDY OF STRICTLY CORRELATED SYSTEMS WITH COMPLEX STRUCTURES", Project No.: OI 114018.

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3. M. Rutonjski, S. Radošević, M. Škrinjar, M. Pavkov-Hrvojević, D. Kapor and M. Pantić: Temperature dependence of sublattice magnetization in quasi-two-dimensional S=1 / 2 cuprate antiferromagnets: Green's function approach, *Physical Review* B 76, 172506 (2007)
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5. M. Manojlović, M. Pantić, M. Škrinjar, D. Kapor, S. Stojanović and M. Pavkov: Thermodynamical properties of the Ising and Heisenberg S = 1 ferromagnet with biquadratic exchange and uniaxial anisotropy, *Physica status solidi* (b) 243, 530 – 541 (2006)
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Members of the Group (from left to right): Mario Škrinjar, Milan Pantić, Milica Pavkov-Hrvojević, Slobodan Radošević and Darko Kapor

7. D. Kapor, M. Pantić, M. Manojlović, M. Škrinjar, S. Stojanović and M. Pavkov: Thermodynamic properties of magnetic bilayers, *Journal of Physics and Chemistry of Solids* 67 698 - 704 (2006)
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LEADING OF PROJECTS

- **Dynamic and thermodynamic characteristics of strictly correlated systems with complex structures**
  Ministry of Science and Environmental Protection
  Duration: 2001–2005
  Project Leader: Prof. Darko Kapor, Faculty of Sciences, Novi Sad.
- **Theoretical studies of strictly correlated systems with complex structures**
  Project No.: OI 114018; Ministry of Science and Technological Development of the Republic of Serbia.
  The Project started in 2006
  Project Leader: Prof. Darko Kapor, Faculty of Sciences, Novi Sad.

METEOROLOGY AND ENVIRONMENTAL FORECASTING

Studies carried out in the frame of the Center of Meteorology and Environmental Forecasting are primarily aimed at a better understanding and modeling of the processes adjacent to or on the very biophysical surfaces (environmental surfaces), and related to the most important effects of these interactions. In view of the complexity of the problem, the research encompasses only a small portion of physical and partly biological processes by which these interactions can be described. In the very focus of the work of the Center in the future will be the study of nonlinear processes and phenomena in physics and other scientific areas that are concerned with environment, as well as the attempt, if not to solve, but at least to understand and explain the problem of predictability of the observed systems and processes.

The Group submitted proposal for two large international projects, one of which is from the FP7 of the European Union – PROADAPT (Multiscaling PROcedure for ADAPTation Measures to Climate Change in Agroecosystems for Assessing Impacts to Key Sectors in Europe), and the other is in the frame of the bilateral cooperation with the Nonlinear Science Laboratory, Department of Earth and Planetary Sciences, Graduate School of Science, Kobe University (Japan).

The Group activities encompass also organization of meetings and workshops (national meeting with manufacturers in the frame of ADAGIO project and workshop in the frame of the FP6 RPR-CMEP).

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- Dr Darko Kapor, full professor
- Dr Borivoje Rajković, associate professor
- Dr Miroslav Malešević, full professor
- Dr Zoran Mijatović, full professor
- Dr Mirko Budinčević, full professor
- Dr Branislava Lalić, assistant professor
- Dr Radivoje Jevtić, scientific adviser
- Ilija Arsenić, MS, teaching assistant
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- Ana Ćirišan, MS, junior researcher
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Cooperation

The Center has established very close cooperation with the Institute of Physics, Belgrade, as well as with several institutions from abroad such as BOKU University from Vienna (Austria), University of Florence (Italy), University of Naples (Italy) and INRA from Avignon (France)

Team of the Center of Meteorology and Environmental Forecasting

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7. Mihailovic, D.T., Balaz, I. 2007: An essay about modeling problems of complex systems in environmental fluid mechanics. *Idojaras*, 111(2-3), 209-220
8. Mihailovic, D.T., and Alapaty, K., 2007: Intercomparison of two K-schemes: Local versus non-local in calculating concentrations of pollutants in chemical and air-quality models. *Environ. Modell. Softw.,* 22 (11), 1685-1689

Equipment

The equipment has been acquired in the frame of the Project Reinforcement of the Research Potential in Center for Meteorology and Environmental Predictions (RRP-CMEP) from the Sixth Framework Programme (FP6) of the European Union:

- 72 - Processor PC cluster
- Mictropos II Ozonometer
- UV Solar simulator
- Mobile polythermostat (Hotcold-a refrigerated cabinet 2101502)
- μMETOS (mini meteorological station)
- Labo autoclave (STEM STERILIZER PS 4060L)
- Reflectometer RQ-flex

LEADING OF PROJECTS

- **Reinforcement of the Research Potential in Center for Meteorology and Environmental Predictions (RRP-CMEP)**
  Financed from the Sixth Framework Programme (FP6) of the European Union
  Duration: January 1, 2007 – June 30, 2009
  Project Leader: Prof. Dragutin T. Mihailović, Faculty of Sciences, Novi Sad.
  Project objective: Advancement of scientific and research capacities of the Center of Meteorology through the procurement of equipment, engagement of young researchers, and establishing and maintaining contacts with other scientific institutions in EU.
  Results achieved in 2008: Installment and putting into operation all of the procured equipment, preparation of Internet presentation; engagement of the third junior researcher; preparation of a pamphlet about the Center.

Cluster of computers in the Center for Meteorology and Environmental Forecasting

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Chapters in the books of international importance

1. C. Gualtieri and D.T. Mihailovic, (eds.) 2008: Fluid Mechanics of Environmental Interfaces, Taylor & Francis Ltd, pp. 339
2. D.T. Mihailovic, M. Miloradov and G. Telegdi (eds.) 2008: Environmental and Social Issues in The Down Danubian Region: Multydisciplinary approaches, Scientific World

PARTICIPATION IN PROJECTS

- **ADAptation of aGriculture in European regIOns at environmental risk under climate change (ADAGIO)**
  Financed in the frame of the FP6 Program of European Union.
  Duration: January 1, 2007 – June 30, 2009
  Project Leader: Prof. Josef Eitzinger, Institute of Meteorology, University of Natural Resources and Applied Life Sciences (BOKU), Austria.
  The aim of the project: Analysis and evaluation of actual and potential adaptation measures in agriculture on climatic changes specific for the region of Serbia. Consideration of possible scenarios for the future climatic changes based on the existing prediction models.
  Activities: Analysis of the observability of climatic changes on the process of growing agricultural plants, establishing of a permanent network for exchange of information between producers and experts, to improve efficiency of implementation of adaptation measures.
  Results achieved in 2008: In the frame of the project: a number of articles were published and six pilot investigations were carried out.

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STUDY OF LOESS

The beginnings of loess study at the Department of Geography, Tourism and Hospitality Management are related to the works of Academician Branislav Bukurov. However, systematic research of loess-paleosoil sequences coincided with the forming of the Group for Study of Loess Sediments of the Department of Geography, Tourism and Hospitality Management in 1997. In the course of a relatively short period of time, thanking to the results achieved by the Group members, loess sediments of Serbia have been recognized as one of the most complete and detailed archives of climatological and ecological changes of the European land in the course of millions of years. In addition to studying loess in our country, several research expeditions have been organized in Germany, Romania, Hungary, Ukraine and Kazakhstan. The Group for Loess Study has become the most successful research team (judging from the number of papers published in journals of the SCI list and number of citations) in the field of geography in our country.

In 2006, in co-organization with INQUA (International Union for Quaternary Research), the Group organized in Novi Sad the international conference "Danubius Pannonico Mysicus – Space of Challenges, Danube loess symposium". The works presented at this conference were published in a special issue of the journal Quaternary International (Volume 198, Issues 1-2, pp. 1-266, April 2009; Loess in the Danube Region and Surrounding Loess Provinces: The Marsigli Memorial Volume, edited by Slobodan B. Marković, Ian J. Smalley, Ulrich Hambach and Pierre Antoine).

At the end of August and beginning of September 2009 Novi Sad will be the host of the most important world conference dedicated to the different aspects of loess research "Loessfesto9", which is traditionally held every ten years.

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- Dr Lazar Lazić, full professor
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LEADING OF PROJECTS

- **Loess-paleosoil sequences of Vojvodina – the key for understanding of paleoclimatic and paleoecological transition on the land of Europe**
  Project financed by the Provincial Secretariat for Science and Technological Development of AP Vojvodina
  Project No.: 114-451-00754
  Project Duration: 2007-2008
  Project Leader: Prof. Slobodan Marković
- **Loess Plateaus of Serbia**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 146019
  Project Duration: 2006-2010.
  Project Leader: Prof. Jovan Romelić

PARTICIPATION IN PROJECTS

- **Loess Research in Serbia Federal German Ministry of Education and Research (BMBF). Grant MOE 04/R01.**
  Project Duration: 2004-2005.
  Project Coordinators: Prof. Ludwig Zöller, Universitaet Bayreuth, Germany and Prof. Slobodan Marković

Presentation of the loess profile in Ruma to participants of the conference "Danubius Pannonico Mysicus – Space of Challenges" 2006 – Danube Loess Symposium

7. Marković, S.B., Oches, E.A., McCoy, W.D., Gaudenyi, T., Frechen, M. 2007. Malacological and sedimentological evidence for "warm" climate from the Irig loess sequence (Vojvodina, Serbia). *Geophysics, Geochemistry and Geosystems* 8, Q09008, DOI: 10.1029/2006GC001565.
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11. Buggle, B., Glaser, B., Hambach, U., Marković, S.B., Gerasimenko, N., Glaser, I., Zöller, L. 2008. Geochemical characterization and provenance of South-East and East European loesses (Serbia, Romania, Ukraine). *Quaternary Science Reviews* 27, 1058-1075.
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Cooperation

- Soil Physics Department and Chair of Geomorphology, University of Bayreuth;
- Leibniz Institute for Applied Geosciences (GGA-Institut) S3;
- Geochronology and Isotope Hydrology, Hannover (Germany);
- Department of Geology and Paleontology, University of Szeged, Szeged, (Hungary);
- Department of Geology, University of Pecs (Hungary);
- Faculty of Earth and Life Sciences, Vrije Universiteit, Amsterdam (The Netherlands);
- Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY;
- Department of Geosciences, University of Massachusetts, Amherst;
- MA Department of Natural & Applied Sciences, Bentley College, Waltham (USA);
- Laboratoire de Géographyie Physique, Meudon;
- Ecole Normale Supérieure, Laboratoire de Météorologie Dynamique & CERES-ERTI, Paris;
- Laboratoire des Sciences du Climat et de l'Environnement, Gif-sur-Yvette (France);
- Department of Geography, Memorial University of Newfoundland, St. John, Newfoundland (Canada);
- Laboratory of Mineralogy and Petrology (Luminescence Research Group),
- Geological Institute, Ghent University (Belgium);
- Giotto Loess Research Group, Waverley Materials Project, Nottingham Trent University, Department of Geography, Royal Holloway, University of London, Egham, Surrey (UK);
- Institute of Geophisics, ETH Hönggerberg, Zürich (Switzerland).

CLIMATOLOGY AND HYDROLOGY RESEARCH CENTER

CKHI | CHRC

Centar za klimatološka i hidrološka istraživanja
Climatology and Hydrology Research Center

Members of the Research Group

- Dr Lazar Lazić, full professor
- Dr Dragoslav Pavić, assistant professor
- Dr Vladimir Stojanović, assistant professor
- Dragan Dolinaj, MS, teaching assistant
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The Group for climatological and hydrological research exists and works within the Climatology and Hydrology Research Center founded on March 21, 2008 by the decision of the Council of the Faculty of Sciences, and on the initiative of the present members of the Center, that is, part of the teaching and research staff of the Faculty of Sciences, Department of Geography, Tourism and Hospitality Management. The Group is engaged on collecting, treatment, analysis, and publication of data from the fields of climatology and hydrology. Besides, the Group members publish results of their scientific research concerning the phenomena and processes from the given areas at the local and regional levels.

The Center's research field encompasses the territory of the Republic of Serbia, as well as the study of climatological and hydrological characteristics of the countries in the immediate and wider surroundings: Hungary, Croatia, Slovenia, Romania, Bosnia and Herzegovina, Bulgaria, FYR Macedonia, Greece, Italy, Slovakia, Austria, in the cooperation with scientific institutions from the mentioned countries.

The main goals of the Group, that is the Climatology and Hydrology Research Center, are: Establishing and intensification of cooperation with research institutions whose activities are associated with climatological and hydrological observations and research; Imparting interest in students to get included into the research program of the Center; Organization of specialist and professional training at the outstanding faculties and institutions in Europe, both for the members of the Center and other younger people who just want to join the research team; Offering professional help to companies and other organizations whose activity, directly or indirectly, depends of climatological or hydrological circumstances in a given region; Organization of scientific meetings, seminars, and lectures.

Within the Center, Prof. Lazar Lazić and Stevan Savić, MS, are concerned with climatology research; Assist. Prof. Dragoslav Pavić and Dragan Dolinaj, MS, are primarily interested in the hydrology research, whereas Assist. Prof. Vladimir Stojanović is engaged on the research concerning environmental sustainability and geoecology, the areas that are under direct influence of climatological and hydrological factors.

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3. Dragan Dolinaj, Dragoslav Pavić, Stevan Savić (2008): Hydrological characteristics and problems of the Čalma hydroaccumulation system. *Glasnik SGD* 88, 1: 125-137. (in Serbian).

Members of the Group (from left to right): Stevan Savić, Vladimir Stojanović, Dragan Dolinaj, Lazar Lazić and Dragoslav Pavić

4. Dragan Dolinaj, Milana Pašić (2008): Cooperation in the navigable course of the Sava river. IV International Symposium on Transboundary Waters Management, Thessaloniki, Greece; 15 - 19 October 2008.
5. Vladan Ducić, Stevan Savić, Jelena Luković (2008): Contemporary temperature changes at the ground surface and in the troposphere over Vojvodina, Serbia. *Geographica Pannonica* 12, 2: 56-61.
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Cooperation

- Jovan Cvijić Geography Institute, Serbian Academy of Sciences and Arts
- Institute of Meteorology RHMZ – Hydrometeorological Bureau of Serbia
- Faculty of Geography, University of Belgrade
- Public Water Management Company "JP Vode Vojvodine", Novi Sad

Equipment

For the research purpose, the Center currently makes use of two automatic meteorological stations of the type Davis VP2, with the accompanying Davis software package Weatherlink.

LEADING OF PROJECTS

- **Preliminary design of the Museum of Water Resources Management in Sremska Kamenica**
  Public Water Management Company "JVP Vode Vojvodine"
  Project Duration: 2007
  Project Leader: Assist. Prof. Vladimir Stojanović

PARTICIPATION IN PROJECTS

- **Loess Plateaus in Serbia**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 146019
  Project Duration: 2006-2010.
  Project Leader: Prof. Jovan Romelić, Faculty of Sciences, Novi Sad.

DEMOGRAPHIC RESEARCH

Demographic investigations are performed in several areas such as analysis of the change of the number, density and territorial distribution of population, natural movement and migration of population, nuptiality, as well as study of different population structures such as, for example, age, socio-economic, educational, ethnic, and confessional structures.

All members of the Research Group participate actively in teaching of the subjects related to social geography, regional geography, and tourism, and the majority of them are also engaged on the programs of the strategy of communal development.

SELECTED REFERENCES

1. Bubalo-Živković, M., Đurđev, S.B., Dragin, A. (2008): The Ageing of Vojvodina's Population between 1953 and 2002 with Reference to Middle Adulthood and Ageing Index. *Geographica Pannonica,* 12/1: 39-45.
2. Dragin, A., Djurdjev, B., Armenski, T. (2008): Is the international tourist cruising the Pan-European Corridor 7 through Serbia really traveling of third age people? *Glasnik Srpskog geografskog društva*, LXXXVIII, 4: 29-38. (in Serbian)
3. Kovačević, T., Bubalo-Živković, M., Ivkov, A. (2008): Age-sex Structure of Slovenians in Vojvodina in the Second Half of 20th and on the Beggining of 21st Century, *Dela*, 29: 131-144.
4. Djurdjev S.B., Pavić, D., Cvetanović, M., Mészáros, M., Kugler, J. (2007): Az oktatás-képzés, átképzés szerepe a Magyarkanizsai község és a Homokháti kistérség népességmegtartásában és a határon átívelő kapcsolatok erősítésében. In: Határkonstrukciók magyar-szerb vizsgálatok tükrében. Magyar Tudományos Akadémia, Regionális Kutatások Központja, Alföldi Tudományos Intézet, Békéscsabai Osztály, pp. 95-113.
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8. Djurdjev S.B., Košić, K., Dragin, A. (2007): Demographic growth and development of spa places in Serbia, *Glasnik srpskog geografskog društva*, 1: 69-78. (in Serbian)
9. Ivkov, A., Djurdjev S.B., Dragin, A. (2007): Changes in the number and structure of households and apartments in Vojvodina in the second half of the 20th century, *Demografija*, 4: 155-162. (in Serbian)
10. Bubalo-Živković, M., Ivkov, A., Kovačević, T. (2007): Migrations in Bačka from the World War II to 2002, *Demografija*, 4: 103-116. (in Serbian)
11. Ivkov, A., Dragin, A., Kovačević, T., Djurdjev, B., Ivanović, Lj. (2007): Influence of Tourism on the Employment in Vojvodina, *Geographica Pannonica*, 11: 54-58.

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Cooperation

The development of international cooperation is one of priorities of the Group. From 2005, the Group has actively participated in the program "2H2S" of the Doctoral School from Ange (France), and from 2007 it has been included in the "HERODOT" University Level Geographic Network, Liverpool (Great Britain).

Group members (upper row, from left to right): Tamara Kovačević, Aleksandra Dragin, Nevena Ćurčić, Aleksandra Stanojlović, Milka Bubalo-Živković, Andjelija Ivkov-Džigurski, Danijela Arsenović, Tanja Armenski; (lower row, from left to right): Branislav Djurdjev, Bojan Djerčan and Milan Cvetanović

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LEADING OF PROJECTS

- **Demographic Transitions in Serbia**
  Ministry of Science and Technological Development of the Republic of Serbia; 2006-2010
  Project Leader: Prof. Branislav S. Djurdjev.
- **Preparation of the program for revitalization of depopulated borderline areas of Banat**
  Provincial Secretariat for Science and Technological Development; 2008-2009.
  Project Leader: Assist. Prof. Andjelija Ivkov.
- **Vojvodina Center for Spatial Information**
  Provincial Secretariat for Science and Technological Development; 2007-2008.
  Project Leader: Prof. Branislav S. Djurdjev.
- **Program of Demographic Development of AP Vojvodina with Measures for Its Implementation**
  Provincial Secretariat for Demography, Family and Social Care for Children; 2005-2006.
  Project Leader: Prof. Branislav S. Djurdjev.

PARTICIPATION IN PROJECTS

- **Strategies of Development of Temerin, Šid and Nova Crnja Municipalities**
  Vojvodina CESS Project; 2009-2010
  Head of the Expert Group for Geography and Human Resources: Prof. Branislav S. Djurdjev.
- **Valorization of the Demographic State Development of the City of Novi Sad and its Settlements**
  URBIS Project; 2009-2010.
  Project Leader: Prof. Branislav S. Djurdjev.
- **Strategy of the Development of Žitište Municipality**
  Vojvodina CESS Project; 2007.
  Head of the Expert Group for Geography and Human Resources: Prof. Branislav S. Djurdjev.
- **Program of Economic Development of AP Vojvodina, updated ex post analysis**
  Provincial Secretariat for Economy; 2006.
  Head of the Group for Human Resources: Prof. Branislav S. Djurdjev.

Other Activities

Professor Branislav S. Djurdjev is a member of the Managing Board of Matica Srpska for Social Sciences, Vice-president of the Commission for Population Policy of Vojvodina, President of the Serbian Demographic Society. He is also a member of the Population Association of America and European Association for Population Studies. In the period 2006/09 he was Vice-rector of the University of Novi Sad, and since 2009 a member of the Education Council of the Republic of Serbia.

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2. Kicošev Saša, Milka Bubalo-Živković, Andjelija Ivkov (2006): Population of Bačka, Faculty of Sciences, Department of Geography, Tourism and Hospitality Management, Novi Sad pp. 1-246. (in Serbian)
3. Kicošev Saša, Milka Bubalo-Živković, Andjelija Ivkov (2006): Population of Banat, Faculty of Sciences, Department of Geography, Tourism and Hospitality Management, Novi Sad pp. 1-263 (in Serbian).

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REGIONAL GEOGRAPHY

Regional Geography unites and puts into function the knowledge gained in the frame of particular geographical disciplines whose information define and explain formation and characteristics of particular regions. Research interests of the Group members are mainly related to three areas of regional-geography studies, founded on the bases and parameters of: natural criteria, demographic and other socio-geographic criteria, and tourism phenomena.

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Members of the Research Group

- Dr Rade Davidović, full professor
- Dr Jovan Plavša, full professor
- Dr Gordana Jovanović, associate professor
- Dr Milka Bubalo-Živković, assistant professor
- Dr Tamara Kovačević, assistant professor
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Cooperation

- School for Doctoral Studies, Ange (France)
- Universite Lumier, Lyon (France)

PARTICIPATION IN PROJECTS

- **Demographic Transitions in Serbia**
  Ministry of Science and Technological Development, 2006-2010.
  Project Leader: Prof. Branislav Djurdjev, Faculty of Sciences, Novi Sad
- **Loess Plateaus in Vojvodina**
  Ministry of Science and Technological Developoment, 2006-2010
  Project Leader: Prof. Jovan Romelić, Faculty of Sciences, Novi Sad
- **Preparation of the Program of Revitalization of Depopulated Borderline Regions of Banat**
  Provincial Secretariat for Science and Technological Development, 2008-2009.
  Project Leader: Assist. Prof. Andjelija Ivkov-Džigurski.

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Rade Davidović and Tamara Kovačević at the field work in the Drina River valley

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Other Activities

From 2005 the Group has actively participated in the program "2H2S" of the School for Doctoral Studies from Ange (France), and since 2007 it has been a member of the "HERODOT" Network for geography study at the university level from Liverpool (Great Britain). All Members of the Group are active in the Serbian Geographic Society and Matica Srpska, and Prof. Jovan Plavša also is a member of the National Geographic Society (USA). During the past decade the Group members have been engaged on the preparation of different thematic maps for the Faculty of Sciences (2001-2008), Provincial Secretariat for National Minorities (2007), Department of Culture of Vojvodina (2004) and Regional Agency for Development of Small and Medium Companies, Alma Mons (2008).

SUSTAINABLE AND ECOTOURISM IN PROTECTED NATURAL RESORTS

Members of the Research Group

- Dr Lazar Lazić, full professor
- Dr Vladimir Stojanović, assistant professor
- Dr Dragoslav Pavić, assistant professor
- Dr Jovan Romelić, full professor
- Dr Andjelija Ivkov-Džigurski, assistant professor
- Dr Aleksandra Dragin, assistant professor
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Sustainable tourism as a form of tourism development in which the influence of tourism on the environment is strictly controlled represents an important element of modern tourism. Hence, the balanced environmental, economic and socio-cultural components of tourism are increasingly more often mentioned in the programs and strategies of tourism development. Sustainable tourism is an especially applicable category in the tourism development in protected natural resorts. These natural entities (national parks, natural parks and resorts) represent increasingly more popular places for various segments of the tourism offer. Most often it is ecotourism – modern form of tourism in which education, volunteering activities and learning about nature, help to preserve and protect nature.

Tourism development in protected natural assets is especially sensitive, and as such assumes the determination of the bearable capacity, limits of acceptable changes, ecological assessment of influences, tourism zoning and conceiving of the ethical codex that would help tourists in a best way to harmonize their activities with the values of the environment.

The aim of the formation of this research group was the popularization of tourism as an important activity in managing natural resorts, conceiving of tourist programs that will not disturb natural values of protected areas, creating plans and strategies of tourism development based on the bearable capacity and preserving the environmental values, as well as an incentive in the development of natural, ecotourism and sustainable tourism in the ecologically most valuable regions of our country.

"Protected Natural Resorts and Ecotourism of Vojvodina" – Field research in SRP Gornje Podunavlje (2004): Vladimir Stojanović, Dragoslav Pavić and Lazar Lazić

Group members (from left to right): Aleksandra Dragin, Jovan Romelić, Kristina Košić, Vladimir Stojanović, Lazar Lazić and Dragoslav Pavić

SELECTED REFERENCES

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2. Lazić, L., Pavić, D., Stojanović, V., Tomić, P., Romelić, J., Pivac, T., Košić, K., Besermanji, S., Kicošev, S., (2008): Protected Natural Resorts and Ecotourism in Vojvodina, Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad, pp. 1-272.

"Protected Natural Resorts and Ecotourism of Vojvodina" – SRP Stari Begej – Carska bara; "Cesar's Boat" (2008)

Cooperation

- Provincial Secretariat for Environmental Protection and Sustainable Development
- Department of Nature Protection of Serbia, Working Unit Novi Sad

LEADING OF PROJECTS

- **Protected Natural Resorts and Ecotourism of Vojvodina**
  Provincial Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina.
  Project Duration: 2004; 2008
  Project Leaders: Prof. Pavle Tomić † (2004) and Prof. Lazar Lazić (2008).
  The project included a complex study of all relevant characteristics and functions of protected natural resorts in Vojvodina (national parks, special national resorts, natural parks, and areas of special features), published in the monograph "Protected Natural Resorts and Ecotourism of Vojvodina". Each of the natural resorts is presented through the most important natural characteristics – relief, climate, hydrography, plant and animal world; degradation and measures of protection and, finally, potentials for tourism development.
- **General Desing "Gudurica – Destination of Eco-rural Tourism"**
  Municipality Assembly of Vršac, Sector for Environmental Protection.
  Project No. 479.
  Project Duration: 2006.
  Project Leader: Assist. Prof. Vladimir Stojanović.
  The project defines the basic postulates of the potential destination of eco-rural tourism in Gudurica and its surroundings. It also includes the assessment of the utility values of natural and cultural resources, analysis of the receptive base development, analysis of conservation and reconstruction of objects important for vine tourism, elaboration of the offer diversity concept, study of uniting tourism with the other economic activities.

PARTICIPATION IN PROJECTS

- **Study of the State of the Environment in AP Vojvodina, 1998-2008.**
  Provincial Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina.
  Project Duration: 2009
  Project Coordinator: Prof. Lazar Lazić, Faculty of Sciences, Novi Sad
- **Sustainable Utilization and Presentation of Protected Natural Values in the Danube Area of Vojvodina**
  Society of Young Researchers "Branislav Bukurov"
  Project Duration: 2008/2009
  Project Leader: Assist. Prof. Vladimir Stojanović
- **Establishing of ecotourism as a tool for improving transboundary management of the Lower Drava and Danube River confluence in Croatia, Hungary and Serbia-Montenegro**
  Blue Danube and WWF International – DCP
  Project Duration: 2006
  Project Coordinator: Assist. Prof. Vladimir Stojanović
- **Ecological education and active protection of natural values of the region adjacent to the Mostonga River**
  Ecological Movement "Green Horizon", Odžaci, financially supported by the Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina
  Project Duration: 2005
  Project Leader: Assist. Prof. Vladimir Stojanović

"Protected Natural Resorts and Ecotourism of Vojvodina"– SRP Deliblatska Peščara (2004)

3. Tešić, O., Stojanović, T., Marić, B., Vig, L., Puzović, S., Pil, N., Stojnić, N., Lazić, L. (2008): Ramsarian Areas of Vojvodina – Stari Begej - Carska bara, Provincial Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina, Novi Sad, pp. 1-168.
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6. Stojanović, V., (2004): The Main Principles of Ecotourism, Hotellink, No. 4, College of Hotel Management, Belgrade. (in Serbian)
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"Protected Natural Resorts and Ecotourism of Vojvodina" – PP Jegrička (2008)

"Protected Natural Resorts and Ecotourism of Vojvodina" – PP Begečka Jama (2008)

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12. Stojanović, V., Pavić, D., (2001): Organization of Tourism in Protected Nature – Example of the Special Natural Resort Gornje Podunavlje, XIV Congress of Geographers of Yugoslavia. (in Serbian).

"Protected Natural Resorts and Ecotourism of Vojvodina" – NP Fruška Gora (2004)

Other Activities

- Organization of scientific seminars on environmental protection and sustainable development (including tourism) of protected natural resorts,
- Organization of educational seminars on the possibilities of sustainable utilization of natural values,
- Organization of round-table discussions,
- Programs of education of local population and schoolchildren related to the source natural values of protected assets and their preservation,
- Elaboration of the strategies for sustainable tourism development of natural resorts and other destinations needing activities of sustainable tourism,
- Elaboration of scientific-popular and advertising publications about protected natural resorts and other ecotourism destinations,
- Propositions and other planned measures of tourist arrangement of protected natural resorts by the criteria of sustainable destination

CULTURAL TOURISM

Cultural tourism is one of the most important forms of tourism, and it is based on certain cultural values. The development of tourism in Serbia may be founded on the rich and very diverse cultural heritage. The promotion of cultural tourism in Serbia would contribute to a faster development of the identity and image of Serbia as a tourist destination. Because of that it is necessary to include cultural tourism of Serbia into all developmental plans at all the levels. In Serbia, cultural tourism has not been included yet in the plans of tourism development and there still exists a faulty attitude that culture is an element of the product of mass tourism.

The team engaged on studying cultural tourism is focused on singling out and considering factors that are significant for the development of cultural tourism in Serbia:

- Degree of attractiveness that influences decision making of tourist's choice of destination;
- Distinctivity, which includes several elements such as authenticity of the attractions and their local identity, quality of products and services, and precise aiming at the market segments;
- Grouping attractions of higher and lower attractiveness;
- Brand forming, as one of the very important factors of a successful development of cultural tourism;
- Sustainability, which represents an assessment of the destination capacity for receiving tourists, and which makes the basis for operative plans of development and planning strategy in general.

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Members of the Research Group

- Dr Olga Hadžić, academician
- Dr Jovan Romelić, full professor
- Dr Jovan Plavša, full professor
- Dr Lazar Lazić, full professor
- Dr Snežana Besermenji, associate professor
- Dr Jasna Jovanov, assistant professor
- Dr Vladimir Stojanović, assistant professor
- Dr Andjelija Ivkov-Džigurski, assistant professor
- Dr Nevena Ćurčić, assistant professor
- Dr Aleksandra Dragin, assistant professor
- Dr Tatjana Pivac, assistant professor
- Kristina Košić, MS, teaching assistant
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Cooperation

- International Institute of Tourism, Ljubljana, Slovenia

ography "Geographic Researches in the Carpathian-Danube Space", Timisoara, pp. 687-701.
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3. Ivkov Andjelija et al. (2006): Folklore Heritage in Tourism of Banat. Department of Geography, Tourism and Hospitality Management, Faculty of Science, Novi Sad.

LEADING OF PROJECTS

- **Possibility of the Development of Cultural Tourism in Vojvodina**
  Provincial Secretariat for Science and Technological Development of AP Vojvodina
  Project Leader: Prof. Snežana Besermenji, Faculty of Sciences, Novi Sad.
  The project objective: to create directives for a sustainable development of cultural tourism in Vojvodina, which, by its specific features, permeation of different cultures and its complex national composition, may represent an attractive destination. In the European Union and countries with high-income people, cultural tourism is increasingly more popular, and Vojvodina might become a destination that would attract this, more and more dominating segment of tourism.

Other Activates

Prof. Snežana Besermenji is a member of the Standing Committee of World Cultural Tourism Association and member of the Scientific Committee of World Cultural Tourism Association.

EDUCATION AND RESEARCH IN RURAL TOURISM

Members of the Research Group

- Dr Lazar Lazić, full professor
- Dr Vladimir Stojanović, assistant professor
- Dr Jovan Romelić, full professor
- Dr Andjelija Ivkov-Džigurski, assistant professor
- Kristina Košić, MS, teaching assistant
- Uglješa Stankov, MS, junior researcher
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Cooperation

- Ministry of Economy and Regional Development
- Provincial Secretariat for Agriculture
- Tourist Organizations of municipalities Odžaci, Vršac and Bela Crkva

Rural tourism has been included in the priorities of tourism development in Serbia. We are witnesses that rural areas, especially those more remote from developed urban entities, experience an increasing depopulation caused by economic uncertainty and lack of developmental actions. Rural tourism seems to be an appropriate means for revitalization of abandoned rural areas and their sustainability in the future, through preserving jobs and creating new ones, increasing occupational diversity, services, and preservation of the landscape as tourist attraction.

The lack information and knowledge is one of the main problems of the development of rural tourism. In its particular segments, this growing branch of Serbian tourism economy does not satisfy elementary principles. Such tendencies might lead rural tourism in a wrong direction (poor services, inappropriate presentation of resources, disregard of the quality management principle, obsolete ways of promotion, etc.).

The aim of forming this research group was to increase the quality of services in rural tourism through education of people interested to pursue this form of tourism.

The main activities of the Research Group are concerned with the organization of various educational seminars in rural tourism, publication of scientific papers on rural tourism, and organization of round-table discussions and creative workshops.

Project "Education in Rural Tourism" – Bački Monoštor, June 2007.

Group members (from left to right): Jovan Romelić, Mirjana Penić, Vladimir Stojanović, Kristina Košić, Lazar Lazić, Andjelija Ivkov-Džigurski and Uglješa Stankov

The Group is primarily involved in the research of the state and perspectives of rural tourism in Vojvodina and Serbia, but it also studies the level of development of rural tourism in the countries in the close and wider surroundings (Hungary, Slovenia, Croatia, Greece, Austria, etc.).

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LEADING OF PROJECTS

- **Education in Rural Tourism**
  Ministry of Commerce, Tourism and Services, NIP.
  Project No.: 1589
  Project Duration: 2006/07.
  Project Leader: Prof. Lazar Lazić, Faculty of Sciences, Novi Sad
- **Strategy of the Development of Tourism in the Odžaci Municipality**
  Tourist Organization of Odžaci Municipality.
  Project Duration: 2007
  Project Leader: Assist. Prof. Vladimir Stojanović
- **General design "Gudurica – Destination of Eco-rural Tourism"**
  Assembly of the Vršac Municipality, Sector of Environmental Protection
  Project No.: 479.
  Project Duration: 2006
  Project Leader: Assist. Prof. Vladimir Stojanović.

PARTICIPATION IN PROJECTS

- **Program of education aimed at revitalization of rural regions by linking agriculture, ethno heritage and tourism**
  Provincial Secretariat for Agriculture, Forestry and Water Resources and Center for Rural Development Aurora, Chamber of Commerce of Vojvodina.
  Project No.: 104-320-00011/2008-I-33
  Project Duration: 2008
  Project Leader: Dr Maja Timotijević, Faculty of Agriculture, Novi Sad.

Activities

- Organization of scientific meetings;
- Organization of educational seminars on rural tourism for people working in local self-government institutions, tourist organizations, small entrepreneurs, farmers, and tourism households in rural areas, as well as for the future entrepreneurs in rural tourism;
- Offering professional help to all those interested in the services in rural tourism in order they could place their product on the market in a best way;
- Preparation of strategies for the development of rural tourism for given destinations, municipalities, regions;
- Intensification of cooperation with other researchers and institutions involved in rural tourism, with the aim of exchange experience and joint applications for international projects;
- Participation in creative workshops and round-table discussions;
- Publication of research papers.

Project "Education in Rural Tourism" – Professional excursion of participant to Slovenia; kmetija Ploder, Prevalje, September 2007.

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Presentation of rural tourism offer is a prerequisite for a successful development – Dužijanca, Mala Bosna

12. Romelić, J., Plavša, J., Stojanović, V. (2005): Concept of the Creation of Eco-rural Tourism Destination on the Example of Gudurica Settlement, *Geographica Pannonica*, 9: 51- 58.
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Rural tourism contributes to the preservation of environmental values that are indispensable for tourist presentation – Rokin Salas, Ludaško lake

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To ensure quality of services in rural tourism, like it exists in the other countries of the region and Europe, it is necessary to instruct providers of services - Nikola Ivanić, Perkov salaš (farm), Neradin

Plans

The Group plan for the current 2009 is to prepare project proposals for international projects which would enable further research and to found a Center for education and research in rural tourism.
The formation of the Center would enable organization of educational meetings; modernization of marketing in rural tourism, implementation of modern principles of organizing educative meetings according to the model of developed destinations, to work on establishing international cooperation and projects, to carry out inventory and presentation of the offer in rural tourism, as well as launching rural of tourism manifestations.

ETHNOTOURISM AND ANIMATION IN TOURISM

The Working Group for Ethnotourism and Animation in Tourism carries out research mainly on the territory of Vojvodina (but also wider), the emphasis being on the possibility of using the folklore heritage in the offer of a given destination in Vojvodina, that is Serbia.

A series of educative workshops and round-table discussions serve to stimulate handicrafts, preservation of folklore heritage, revival of culture and selling of souvenirs, revival of naïve painting, production of healthy food and promotion of culinary traditions, revival of numerous manifestations and customs, development of rural catering.

Through the animation programs as a constitutive part of the tourist offer, which means enrichment of the offer, it is possible to achieve a more pleasant visit to a given destination. The organization of thematic events such as evening presentations serves to promote cultural heritage (cultural-historical monuments) folklore characteristics (music, costumes, customs) and gastronomic characteristics (culinary specialties, traditional drinks) of one of the numerous peoples living in our country, but also the cultures of some other European peoples.

The activities encompass the following aspects:

- First of all it is *teaching of the subjects related to the areas of social geography, physical geography and tourism topics*,
- Organization of thematic evenings related to the subject Animation in Tourism with the aim to promote folklore/ethno heritage of particular peoples and putting that into function of tourism,
- The Group offers the possibility of preparation of the strategic programs for the development of municipalities in Serbia,
- It is necessary to especially point out the activity on popularization of science through conceiving the popular-scientific journal GEA, which has been published since 2001. The Ministry of Science and Technological Development supported financially publishing of this journal in the frame of activities from the program of promotion and popularization of science in 2008,
- *The work on permanent education,* which assumes a series of lectures and workshops for geography teachers in the frame of the project of the Ministry of Education, Sports and Advancement of Education:
  - GIS, multimedia and Internet in the function of educating teachers with the aim of enhancing quality of education, schoolyear 2003/2004;
  - Education of geography teachers to use active teaching methods, schoolyear 2003/2004;
  - GIS, multimedia and Internet in the function of educating teachers with the aim of enhancing quality of education 1, schoolyear 2007/2008;
  - GIS, multimedia and Internet in the function of educating teachers with the aim of enhancing quality of education 2, schoolyear 2007/2008;
  - Interactive teaching – modern teaching of geography, schoolyear 2009/2010. Projects Leader: Assist. Prof. Andjelija Ivkov-Džigurski.

Members of the Research Group

- Dr Andjelija Ivkov-Džigurski, assistant professor
- Dr Jovan Romelić, full professor
- Dr Lazar Lazić, full professor
- Dr Aleksandra Dragin, assistant professor
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Cooperation

- Chamber of Economy of Vojvodina
- Tourist Organization of Vojvodina
- Novi Sad Fair
- College for Tourism and Catering, Bled, Slovenia
- Institute of Pedagogical Research, Belgrade
- Christian Cultural Center, Belgrade

The Group members (from left to right): Aleksandra Dragin, Ljubica Ivanović, Lazar Lazić, Andjelija Ivkov-Džigurski and Jovan Romelić

In the period 2006-2009, 11 projects of thematic evenings were realized concerning Animation in Tourism with the aim of promoting folklore/ethnic heritage of particular peoples and putting it into function of tourism (under the guidance of Assist. Prof. Andjelija Ivkov-Džigurski and Igor Stamenković). The following thematic evenings of donor type were realized:

- *Gipsy Night*, 2006,
- *Mexico in Novi Sad*, 2006, (under auspices of the Embassy of Mexico),
- *Noche de la Cuba*, 2007 (under auspices of the Embassy of the Republic of Cuba),
- *Irish Heartbeat*, 2008,
- *Masked Ball*, 2009,
- *Hungarian Evening* – Sok kicsi sokra megy (Trifles make this evening), 2008; financially supported by the Provincial Secretariat for Education, Project No.: 106-451-04720/2008-01,
- *Greek Evening* – Greece in Novi Sad, January 25, 2009,
- *India Evening*, January 26, 2009 (under auspices of the Embassy of India),
- *French Evening* – Voulez - vous passer la soiree avec nous?!, February 1, 2009,

LEADING OF PROJECTS

- **Folklore Heritage in Tourism of Banat**
  Provincial Secretariat for Culture
  Project No.: 451-02007/2006
  Project Duration: 2006
  Project Leader: Assist. Prof. Andjelija Ivkov, Faculty of Science, Novi Sad
- **Folklore Heritage in Tourism of Backa**
  Provincial Secretariat for Culture
  Project No.: 106-451-03052/06
  Project Duration: 2007
  Project Leader: Assist. Prof. Andjelija Ivkov, Faculty of Sciences, Novi Sad
- **Folklore Heritage in Tourism of Srem**
  Provincial Secretariat for Culture
  Project No.: 451-02007/2006
  Project Duration: 2008
  Project Leader: Assist. Prof. Andjelija Ivkov-Džigurski, Faculty of Sciences, Novi Sad

PARTICIPATION IN PROJECTS

- **Strategy of Tourism Development in the Municipality of Odžaci**
  Tourist Organization of the Odžaci Municipality.
  Project Duration: 2007
  Project Leader: Assist. Prof. Vladimir Stojanović, Faculty of Sciences, Novi Sad
- **Program of education aiming at revitalization of rural regions by linking agriculture, ethnic heritage and tourism**
  Provincial Secretariat for Agriculture, Forestry and Water Resources and Aurora Center for rural development and Chamber of Economy of Vojvodina.
  Project No.: 104-320-00011/2008-I-33.
  Project Duration 2008.
  Project Leader: Dr. Maja Timotijević, Faculty of Agriculture, Novi Sad.
- **Ethno-Souvenir Paths**
  Ministry of Economy and Regional Development of the Chamber of Economy of Vojvodina
  Project No.: 300-401-00-877/2008-16.
  Project Duration: 2008
  Project Leader: Stojan Janković, Nevort Association of Citizens

Detail from the India Evening held on January 26, 2009, under auspices of the Embassy of India and in the presence of His Excellency Ambassador Ajay Swarup

- *Spanish Evening* – Amor y corazon de Españoles, (Hot-blood people) February 3, 2009; financially supported by the Provincial Secretariat for Education; Project No.: 106-451-00087/2009-01,
- *Turkish Evening*, February 9, 2009 under auspices of the Embassy of the Republic of Turkey and support of the Novi Sad City Administration for Economy; Project No.: 3-25/2009-II.

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Additional Activities

It should be pointed out the following: Membership in the Commission for standards in tourism and related services of the Institute of Standardization of Serbia, in the frame of the International Commission for Standards and Tourism Services ISO/TC 228, from 2006 (members: Andjelija Ivkov-Džigurski and Aleksandra Dragin). During 2008, Andjelija Ivkov-Džigurski served as a member of the Board of the Association of Catering and Tourism, Chamber of Economy of Vojvodina. During 2006, Andjelija Ivkov-Džigurski served as a professional consultant for professional editing and authoring of the texts on Serbia and Montenegro for Great Encyclopedia of Geography (The Kingfisher), of the Zmaj d.o.o. Publisher from Novi Sad. Since December of 2008 Igor Sramenkovic has been a member of the Executive Board of the Tourist Organization of Novi Sad, which in April of 2009 was registered in the Agency for Economy Registry. The Group experts participated in the preparation of the "Vojvodina Gastronomic Guide" aimed at promoting gastronomic offer of Vojvodina as part of the folklore heritage.

MANAGEMENT AND MARKETING IN TOURISM

Modern tourism is characterized by a strong development at both the world level and the level of particular countries, regions and destinations. To make the tourism development more effective, it must be accompanied by numerous theoretical and practical investigations. Since tourism represents a branch of economy concerning with a number of specialized activities, this means that both theoretical and practical investigations must be of an interdisciplinary character. The Department of Geography, Tourism and Hospitality Management, has been aware of this fact from the very beginning of introducing the tourism major program. Because of that a number of different subjects are taught and the researchers of the Deparment are involved in study of tourism phenomena from various aspects. Interdisciplinarity assumes viewing of the wholeness of the space/geographic component, but also economic, marketing, management, sociological, psychological, and other aspects that are significant for the current and future developmenmt of tourism. Among more significant tourism research activities in which researchers from the Department are involved are those concerning with the problem of management and marketing. And these research activities are related to the level of both tourist destination and tourist company.

When speaking about the management at the level of tourist destination one cannot omit the fact that, in the process of planning of tourism development at the level of a tourist destination, as part of strategic management, it is necessary to include the aspects of touristic valorization, that is the assessment from the aspect of the possibility of inclusion into the tourism product of the destination both its natural and anthropogenic values.

A number of MS and PhD theses that have been defended at the Department have been concerned with the problem of touristic valorization, and hence they belong to the domain of tourist destination management. Through numerous works, based on scientific principles, touristic valorization has been performed for the major part of Podunavlje Region in Serbia, numerous cultural and historical entities, castles in Vojvodina, national parks in Serbia and Montenegro, etc.

Management of the development of a tourist destination assumes also acting in accordance with the principles of sustainable development. A number of papers and scientific books have been written from this field, and they represent a valuable scientific contribution to this domain of tourist destination management.

Various aspects of strategic management in the development of selective tourism forms (vine tourism, hunting tourism, cruising-related tourism) are also subject of interest of this Group and of the Department. Here belong, for example, the works "International Cruising the Corridor 7 and Nautic Tourism of Serbia", Strategy of the Development of Hunting Tourism in Bačka", and "Viniculture and Wine Making in the Tourist Offer of Vojvodina".

Management in cultural tourism is naturally a topic of research in the Department. This problem has been treated best in the PhD thesis entitled "Stakeholder Approach to Sustainable Management of the Development of Cultural Tourism" (O. Hadžić), which may be classified as the research of strategic management of tourist destination with a special emphais on the partner (stakeholder) balancing of interests of different groups in the destination, while taking care about the principles of sustainable development. Strategic management in tourism is studied in a complex way through the analysis of the strategy of the development of tourism in Serbia. The man-

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SELECTED REFERENCES

1. Ćurčić, N., Bjeljac, Ž., Pavlović, N. (2009): Cluster merging in Serbia - an example of Tourists Clusters, 2nd International Conference for Enterpreneurship, Innovation and Regional Development, Thessaloniki, Greece, pp. 347-356.
2. Milojević, I., Markov, S. (2008), Gender, militarism and the view of the future: student's views on the introduction of the civilian service in Serbia, in: *Journal of Peace Education*, Volume 5, Number 2, pp. 175 - 191. (ISSN 1740 - 0201).
3. Markov,S., Savić, S. (2008), Female Goverment in Serbia - one example of lobbying for more women in politics, *Gender Studies*, vol. 1, no. 7/2008, pp. 222 - 231.
4. Nedeljković, S., Markov, S. (2008), Motivation to travel of religious tourists in Serbia - a qualitative analysis, *Turizam*, No. 11, pp. 17-20. (in Serbian),

agement aspects in tourism are also analyzed through the research of international cruising Corridor 7, as well as through some other segments of tourist offer of Serbia. Some investigations have also been concerned with the problem of strategy of the development of hotel management in protected natural resorts.

The teaching staff of the Department have also achieved significant results in the domain of marketing in tourism. The research has been concerned with the problem of the quality of evaluation of the means of tourist advertising and applied cartographic materials in the function of advancing promotive activities in tourism, which demonstrates how the knowledge from the area of traditional geographic subjects can be successfully implemented into the marketing in tourism. A significant contribution to science, that is marketing, has been given through the marketing of research concept in the business of city-type hotels, as well as the application of the concept of marketing of overall relationship in cultural tourism, then in the behavior of potential tourist in choosing a certain destination. These investigations link to some extent modern aspects of psychology and sociology in tourism.

The Geographic Information System (GIS) and Internet in tourism have recently attracted increasing attention of researchers in the domain of management and marketing of tourist destination. Aspects of GIS application have attracted attention of the researchers from the Department, and through their works numerous possibilities of GIS application in the management of tourist destination have been demonstrated. For the Department, but also for the tourism of Serbia, of siginicance are the investigations that analyze the importance of Internet in tourism promotion. The "Web Academy". realized with the partners from Germany, will certainly contribute to the promotion of Serbia tourism abroad.

In the turbulent economic circumstances, a basic prerequisite for the business advancement and achieving competiveness of small and medium companies is the implementation of scientific knowledge into business processes and different forms of integrations. In accordance with these needs, the Department realizes its cooperation with the Srem Tourist Cluster and with the Association for the Development of the business and manifestation tourism.

The most important works dealing with the problem of management and marketing tourism are:

1. Hadžić, O., (2008), Management of sustainable development of cultural tourism in Novi Sad, Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad. (in Serbian),
2. Hadžić, O., Nedeljković, M., (2008), Work motivation and work satisfaction in the company, Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad. (in Serbian),
3. Nedeljković, S., Markov, S. (2008), Motivation to travel of religious tourists in Serbia - a qualitative analysis, *Turizam*, No. 11, pp. 17-20. (in Serbian),
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5. Stojanović, V., (2006): Sustainable development in special natural resorts of Vojvodina, Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad. (in Serbian),
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7. Romelić, J., Stojanović, V., (2006): Development Research of Cultural Tourism in Euro-Region "Danube, Kris, Mures, Tisza", 2nd International Scientific Congress Hosted and Supported by A.T.E.I. Thessaloniki, Progress in tourism and Hospitality: Present and Future Challenges, Thessaloniki.
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10. Markov S. (2005), Women Entrepreneurs in Serbia in the Beginning of the 2000s, *Zbornik za društvene nauke Matice srpske*, No. 118/119,2005, pp. 161-185. (in Serbian).
11. Romelić, J., Plavša, J., Stojanović, V., (2005), Concept of the Creation of Eco-rural Tourism Destination on the Example of Gudurica Settlement, *Geographica Pannonica:* 9: 51-58.
12. Stojanović, V., (2005): Local population in ecotourism on the example of special natural resorts in Vojvodina, Modern Tendencies in Tourism and Hotel Business and Gastronomy, Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad. (in Serbian).
13. Markov S. (1998), Women's cottage industries - a form of revitalization in village areas, in: Europaishe landfrauen auf neuen wegen, Doris Jansen, Mathilde Schmitt, eds. Universitat GH Essen, pp. 157-169.

CENTER OF FOREIGN LANGUAGES OF PROFESSION

Study of foreign language of profession and academic foreign language at the Faculty of Sciences occupies a significant place at all education levels. English and German are taught as both compulsory and facultative subjects. Besides, Spanish, French and Italian are also taught as optional languages.

The Center of Foreign Languages of Profession is located in the Department of Geography, Tourism and Hospitality Management of the Faculty of Sciences. It was founded in October 2007 on the initiative of the Chair of Social Geography and Chair of Geography Teaching Methodology, and its members are all teachers of foreign languages at the Faculty of Sciences.

The objective of founding the Center was to organize more efficiently the process of teaching foreign languages at the Faculty and harmonize the curricula and all the elements of teaching process with the Common European Framework for Foreign Languages and Bologna Declaration. The Center provides for the lecturers the possibility of doing research in the area of educational and applied linguistics, as well as facilitates establishment of cooperation with similar centers in the country and from abroad.

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2. Knežević, Lj. and Vuković Vojnović, D., Content and components of the course for students of natural sciences, International Conference 'Language of Profession: Theory and Practice' – Book of Papers, Society of Foreign Languages and Literature and University of Belgrade, 2009. (in Serbian)
3. Radojičić, S. and Vuković Vojnović, D., Infinitive in English language of profession, International Conference 'Language of Profession: Theory and Practice' – Book of Papers, Society of Foreign Languages and Literature and University of Belgrade, 2009. (in Serbian)
4. Vuković Vojnović, D. and Knežević, Lj., Study of motivation in teaching English as a language of profession, International Congress 'Applied Linguistics Today', Society for Applied Linguistics of Serbia and Montenegro, Faculty of Philology, Belgrade, September 28-30, 2006. (in Serbian)
5. Radojičić, S., (2006): The role of attitudes and motivation in learning English on the example of students of the Faculty of Sciences, International Congress 'Applied Linguistics Today', Society for Applied Linguistics of Serbia and Montenegro, Faculty of Philology, Belgrade, September 28-30, 2006. (in Serbian)

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Membership in Scientific Associations

- Association of Applied Linguistics of Serbia (AALS)
- Serbian Association for Foreign Languages and Literatures, Section of University Teachers of Foreign Languages of Profession (FLLAS)
- English Language Teachers' Association (ELTA, associate member of IATEFL and TESOL)

LIST OF TRANSLATIONS

1. Dragana Vuković Vojnović: Translation into Serbian of the book "Changing Lives Through Redecision Therapy" by Mary McClure and Robert L. Goulding, Psihopolis Institut, Novi Sad, 2007.
2. Stanka Radojičić (2003): Translation into English of the scientific monograph "Novi Sad on the Palm of Your Hand", by P. Tomić et al. Department of Geography, Tourism and Hospitality Management, Faculty of Sciences, Novi Sad.
3. Stanka Radojičić, Marija Nićin (2003): Translation into English of the monograph "Sombor on the Palm of Your Hand, Faculty of Sciences, Novi Sad, 2006.
4. Dragana Vuković Vojnović, Stanka Radojičić, Marija Nićin: Translations of papers and editing for the international journal Geographica Panonnica.

Part of the Group members (from left to right):
Stanka Radojičić, Dragana Vuković Vojnović and Marija Nićin

6. Vuković Vojnović, D. and Knežević, Lj., ESP Classes for Students of Science: from Needs Analysis to Materials Development, International Conference "English and Literature Studies: Interfaces and Integrations", Faculty of Philology, University of Belgrade, 2004.
7. Knežević Lj. (2004) Development of strategies for perceiving text structure in reading teaching, Applied Linguistics, 5, Yugoslav Society for Applied Linguistics, Faculty of Philosophy, Novi Sad, pp. 54-58. (in Serbian)
8. Vuković Vojnović, D., Classification of present perfect tense and present perfect progressive tense and the corresponding forms in Serbian, Book of Papers of the Congress of Applied Linguistics, Yugoslav Society for Applied Linguistics, Herceg Novi, 2003. (in Serbian)
9. Vuković Vojnović, D. and Mrkšić, Lj., Analysis of the needs as a significant source of data in teaching a foreign language of profession, Book of Papers, International Professional Meeting, Yugoslav Society for Applied Linguistics, Faculty of Philosophy, Novi Sad, 2000. (in Serbian)
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12. Mrkšić Lj. (1998) Translating and teaching of a foreign language – usages and abusages, Pedagoška stvarnost, 9-10, Association of Pedagogical Societies of Vojvodina, Novi Sad, pp. 750-755. (in Serbian)

5. Dragana Vuković Vojnović, Stanka Radojičić, Marija Nićin: Translations of abstracts for the journal Turizam.
6. Dragana Vuković Vojnović, Stanka Radojičić, Marija Nićin: Translations of abstracts for the journal Zbornik radova Departmana za geografiju, turizam i hotelijerstvo.

Activities of the Center

- Investigations in the area of applied linguistics and methodology of teaching foreign languages at the university level with the aim of improving methods of teaching foreign languages at the Faculty of Sciences.
- Organization of specialized language courses for individuals and groups – academic linguistic skills in foreign language, business foreign language, preparations for gaining international certificates in foreign languages.
- In 2008, the Center established cooperation with the London Chamber of Commerce and its Center for examination in business English and tourism English, and thus obtained the certificate of accreditation.
- Establishment of cooperation with other similar centers in the region and wider with the aim of organizing joint projects.
- Testing students for the purpose of compulsory summer practice.
- Translating for the needs of the journals *Turizam* and *Geographica Pannonica*, as well as other publications of the Department and the Faculty.
- Written and oral business communication for the needs of the Department of Geography, Tourism and Hospitality Management.

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CHEMISTRY OF MOLTEN SALTS

Research activities of the Group are focused on molten salts chemistry, encompassing study of the reactions of association of metal ions in low-temperature melts (which are used as suitable phase-change materials for heat storage), and also the systems with high melting temperature (physico-chemical characterization and thermodynamics of lanthanide halides).

Molten salts are the systems that can be considered as infinitely concentrated solutions of electrolytes. They may contain certain amount of water or be fully dehydrated. They have a wide application, first of all as the reaction media for the reactions requiring either high temperature or high concentration which cannot be achieved in aqueous solutions. The application of such system may be found in electrochemical and extraction processes (fuel cells, thermal batteries, metal deposition on the electrodes, separation of transition metals from each other, etc.), in the industry of nitrate salts, in hydrothermal processes, as well as in nuclear reactors where they serve as conducting electrolytes. An important application is also for the preparation of alloys for storing hydrogen as the future fuel. Another important property of molten salts has recently enabled expanding their utilization, as they are used as phase-change materials in heat accumulation.

The Group's research is concerned with the study of reactions of cobalt ion complexation with halide ions in selected molten systems that melt at lower temperatures. The most frequently studied binary mixtures of two inorganic salts or of an inorganic salt and an organic component, in the presence of halide complexes of cobalt(II) show the so-called thermochromic effect (color change with the change of temperature). Because of the high latent melting heat they are used as phase-change materials, suitable for accumulation and storage of heat, for the shadow regulation and protection of space from excessive solar heating. The cobalt(II) complexes formed are characterized by determining their stability and important thermodynamic parameters that govern the reactions of their formation. Studies are carried out by spectroscopic method, and the investigated systems are additionally characterized by measuring electric conductivity and thermal characteristics (DSC).

In the frame of cooperation with the Polytechnical Faculty in Marseilles (France) the Group studies thermodynamic, structural and transport properties of rare-earth (lanthanide) halides and their mixtures with halides of alkali metals. These mixtures are characterized by very high melting temperatures, and their study is important because of the wide application – first of all in various nuclear processes or in nuclear reactors. Rare-earth halides are also important as the products of numerous nuclear reactions; they are used for manufacturing alloys, as luminescence materials, etc. The study produced a large number of phase diagrams involving, first of all, europium(II) bromide, ytterbium(II) bromide or cerium(III) bromide with bromides of alkali metals, synthesis of all these compounds, as well as structural analysis (X-ray and Raman spectroscopy) of some of them. It is planned to begin the study of lanthanum electrodeposition at nickel electrode from low-temperature mixtures and ionic liquids with the aim of characterizing alloys suitable for hydrogen storage as the fuel of the future.

Members of the Research Group

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- Borko Matijević, research associate
- Sanja Dožić, junior researcher

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Cooperation

- Ecole Polytechnique, Institut Universitaire des Systèmes Thermiques Industriels, Université de Provence, Aix-Marseille I, France,
- Department of Inorganic and Analytical Chemistry, University of Szeged, Szeged, Hungary,
- Iowa State University, Department of Material Science and Engineering, Ames, Iowa, USA,
- Institute of Inorganic Chemistry and Metallurgy of Rare Elements, University of Technology, Wroclaw, Poland,
- Intitute of Chemistry, Lyngby, Denmark

Equipment

The group has at its disposal several instruments and setups such as UV/VIS spectrophotometer, conductometer, thermostats, pH meters, analytical balances, etc. Thermal measurements are carried out on a Setaram DSC instrument at the Polytechnical Faculty in Marseilles.

Chemistry of Molten Salts Group (from left to right): Borko Matijević, Sanja Dožić, Istvan Zsigrai, Slobodan Gadžurić and Milan Vraneš

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LEADING OF PROJECTS

- **Spectroscopic and thermodynamic study of complexes in multicomponent systems**
  Provincial Secretariat for Science and Technlogical Development of AP Vojvodina;
  Project No.: 114-451-00608;
  Duration: 2005-2010
  Project Leader: Prof. István Zsigrai, Faculty of Sciences Novi Sad
- **The France-Serbia two-year bilateral project "Pavle Savić"**
  Thermodynamic and structural characterization of some rare-earth halides melts and complex compounds as new material in the industrial systems;
  Project No.: 337-00-359/2006
  Duration: 2006-2008
  Project Leaders: Prof. István Zsigrai, Faculty of Sciences Novi Sad and Prof. Marcelle Gaune-Escard Universite de Provence, Marseilles, France.

PARTICIPATION IN PROJECTS

- **Structural, thermodynamic and electrochemical properties of materials for energy conversion and new technologies**
  Ministry of Science and Technological Development of the Republic of Serbia;
  Project No.: 142047G
  Duration: 2005-2010
  Project Leader: Prof. Slavko Mentus, Faculty of Physical Chemistry, Belgrade

CHEMICAL AND BIOLOGICAL STUDIES OF SELECTED NATURAL CARBOXYLIC ACIDS

Within this group there are two subgroups:

- Subgroup for studying natural naphthenic acids of potential importance for agriculture, and
- Subgroup for studying natural bile acids of potential importance for biomedicine

The research team of the first subgroup is concerned with isolation, purification, derivatization, and determination of structure of natural naphthenic acids from Vojvodina crude oils. The synthesized derivatives are subjected to biological investigations such as tests of plant growth hormones, antibacterial and antioxidant tests and tests of plant detoxification from heavy metals.

The research of the second subgroup is focused on the synthesis of keto derivatives of selected bile acids as potential promoters of drug action and transport. Of special interest are the relationships between the structure of synthesized derivatives, their physico-chemical and pharmacological properties.

The Ministry of Science of the Republic of Serbia funded the purchasing of a CEM microwave reactor.

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2. K. Kuhajda, J. Kandrač, V. Ćirin-Novta, D. Miljković: One-pot esterification and selective 3alfa-acetylation of cholic and deoxycholic acid, *Collect. Czech. Chem. Commun.*, 1996, Vol. 61, p. 1073- 1076.
3. Kuhajda, K., Kandrač, J., Kevrešan, S., Mikov, M., Fawcett, J.P: Structure and origin of bile acids: An overview. , *European Journal of drug metabolism and pharmacokinetics*, 2006, Vol. 31, str. 135- 143, ISSN 0378-7966.
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- Dr Slavko E. Kevrešan, full professor, Faculty of Agriculture, Novi Sad
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Cooperation

The Group cooperates with the Faculty of Medicine and Faculty of Agriculture, University of Novi Sad, and with the Department of Analytical Chemistry, University of Cluj, Romania.

Members of the Research Group (from left to right): Slavko Kevrešan, Bojana Prekodravac, Ljubica Grbović, Vera Ćirin Novta, Ksenija Kuhajda, Ksenija Pavlović, Mihalj Poša

6. S. Kevrešan, V. Ćirin-Novta, K. Kuhajda, J. Kandrač, N. Petrović, Lj. Grbović, Ž. Kevrešan: Alleviation of cadmium toxicity by naphthenate treatment, *Biologia Plantarum*, 2004, Vol. 48, str. 453-455, ISSN 0006-3134.
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9. M. Poša, V. Guzsvany, J. Csanadi, S. Kevrešan, K. Kuhajda: Formation of hydrogen-bonded complexes between bile acids and lidocaine in the lidocaine transfer from an aqueous phase to chloroform, *Eur. J. of Pharm. Sciences*, 34 (2008) 281-292.

PARTICIPATION IN PROJECTS

- **Synthesis of selected biologically active molecules of potential interest for biomedicine and agriculture**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 142005;
  Duration: 2006-2010
  Project Leader: Prof. Velimir Popsavin, Faculty of Sciences, Novi Sad.

COMPLEX COMPOUNDS

Members of the Research Group

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- Dr Valerija Češljević, full professor
- Dr Katalin Mészáros Szécsényi, full professor
- Dr Ljiljana Jovanović, full professor
- Dr Vladimir Divjaković, full professor, Department of Physics
- Dr Ljiljana Vojinović-Ješić, assistant professor
- Dr Violeta Jevtović, assistant professor
- Milena Rakočević, junior researcher
- Berta Holló, PhD student, junior researcher

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The Group's research encompasses non-template and template syntheses, physico-chemical, structural, and biological characterization of new transition metal complex compounds with different classes of not only commercial and noncommercial, but also of newly prepared O-, N-, S- Se- and P-bonding organic ligands of different denticity. Among these ligands prevail those of the type of Schiff base derivatives of bifunctional carbonyl compounds (salicylaldehyde, pyridoxal, 2-hydroxy-1-naphthaldehyde, 2-acetylpyridine, 2-(diphenylphosphino) benzaldehyde, diketons, etc.). and amines (semi-, thiosemi-, selenosemi- and isothiosemicarbazide, aminoguanidine, Girard reagents, etc), and pyrazole derivatives. The research yielded scientifically valuable results, of which is necessary to point out especially the syntheses of complexes with isothiosemicarbazides, for which it has been believed for a long time that they are not active with respect the reactions with metal ions, then the syntheses of complexes with organic ligands with organic ligands (some tetra- and octadentate Schiff bases, formamide pyrazole derivatives, etc.), unknown in the organic chemistry itself, and complexes of iron and nickel containing these metals in their less common (higher) oxidation states. The structures of more than 100 complex compounds have been determined by X-ray diffraction analysis of monocrystals, revealing among them interesting and diverse structural characteristics and coordination polyhedra, along with those exhibiting unusual coordination modes of some of the ligands.

The results obtained have been published in more than 180 papers, of which majority (more than 160) appeared in international journals, one scientific monograph, and one review paper. Besides, the results have been presented at domestic and international scientific conferences (about 200 contributions).

Physico-chemical characterization of the obtained compounds is carried out using the following equipment: TA Instruments SDT Q600 (thermal analysis), Thermo Nicolet NEXUS 670 FT-IR(IR), Spectrophotometer T80+UV/vis PG Instruments Ltd(UV-vis), Bruker AC 250E NMR Spectrometer (NMR), Magway MSB-Mk1(magnetic), AUTOLAB PGSTAT 12/30/302 (voltammetric) and Conductivity Meter Jenway 4010 (conductometric measurements), as well as the instrumentation for X-ray structural analysis of monocrystals (GEMINI S Oxford Diffraction).

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Group members (from left to right): Ljiljana Jovanović, Berta Hollo, Desanka Nikitović, Katalin Mesaroš Sečenji, Vukadin Leovac, Ljiljana Vojinović Ješić, Valerija Češljević

3. V. M. Leovac, M. D. Joksović, V. Divjaković, Lj. S. Jovanović, Ž. Šaranović, A. Pevec, "Synthesis, spectroscopic and X-ray characterization of a copper(II) complex with the Schiff base derived from pyridoxal and aminoguanidine: NMR spectral studies of the ligand", *J. Inorg. Biochem.* 101 (2007) 1094-1097.
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Cooperation

The Group has a very developed cooperation with researchers from both domestic and international institutions. Among national institutions it should be mentioned the Vinca Institute of Nuclear Sciences, Faculty of Chemistry in Belgrade, Faculty of Sciences in Kragujevac, and the Institute of Oncology in Sremska Kamenica. Of foreign institutions, valuable cooperation has been established with the Technical and Economics University and Institute of Structural Chemistry of the Chemical Research Center of the Hungarian Academy of Sciences in Budapest (Hungary); Laboratory for Structure, Properties and Modeling of Solid Substances of the Central School in Paris (France); Chemical Faculty from Kishinev (Moldova); Faculty of Metallurgy and Technology in Podgorica (Montenegro), and Faculty of Chemistry and Chemical Technology in Ljubljana (Slovenia).

LEADING OF PROJECTS

- **Synthesis, physical, structural and biological characteristics of new complex compounds**
  Ministry of Sciences and Technological Development of the Republic of Serbia;
  Project No.: 142028
  Duration: 2006-2010
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Novi Sad.
- **Transition metal complexes with some Schiff bases and pyrazole derivatives**
  Provincial Secretariat for Science and Technological Development;
  Duration: 2005-2010
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Nov Sad.
- **Synthesis and structure of transition metal complexes with Schiff bases of pyridoxal derivatives,**
  Faculty of Sciences Novi Sad and Faculty of Chemistry and Chemical Technology, Ljubljana (Slovenia);
  Duration; 2005-2006
  Project Leaders: Prof. Vukadin M. Leovac and Prof. I. Leban.
- **Physico-chemical, structural and biological studies of complex compounds**
  Ministry of Science and Environmental Protection of the Republic of Serbia;
  Duration: 2002-2005
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Novi Sad.

ylpyrazole and 5-amino-4-carboxamide-1-phenylpyrazole", *Inorg. Chim. Acta* 353 (2003) 253-262.

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17. V. M. Leovac, E. Z. Ivegeš, V. I. Češljević, V. Divjaković, U. Klement, "Pentagonal-bipyramidal manganese(II) complexes with 2,6-diacetylpyridine bis(S-methylisothiosemicarbazone) (H2L). Crystal and molecular structure of [Mn(NCS)(H_2L)MeOH]NCS ", *J. Serb. Chem. Soc.* 62 (1997) 837-845.
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20. V. M. Leovac, B. Ribár, Gy. Argay, A. Kálmán, I. Brčeski, "Synthesis and X-ray crystal structure of the first phosphorus-bonded thiosemicarbazide complex: [2-(diphenylphosphino)benzaldehyde thiosemicarbazonato(1-)] pyridine-nickel(II)-nitrate", *J. Coord. Chem.* 39 (1996) 11-19.
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22. V. M. Leovac, Lj. S. Jovanović, V. I. Češljević, L. J. Bjelica, V. B. Arion, N. V. Gerbeleu, "Synthesis, physicochemical properties and voltammetric characterization of Fe(III) complexes with ter- and quadridentate thiosemicarbazide derivatives", *Polyhedron* 13 (1994) 3005-3019.

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- **Synthesis of potentially bioactive coordination compounds**
  Federal Ministry of Development, Science and Environment;
  Duration: 1994-2000
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Novi Sad.
- **Synthesis, structure and properties of coordination compounds and other substances;**
  Ministry of Science and Technology of the Republic of Serbia;
  Duration: 1996-2000
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Novi Sad.
- **Studies in the field of inorganic synthesis of new products**
  Ministry of Science and Technology of the Republic of Serbia;
  Duration: 1991-1995
  Project Leader: Prof. Vukadin M. Leovac, Faculty of Sciences, Novi Sad.

The coordinator of all the above projects has been Faculty of Sciences in Novi Sad, and the partners were researchers from other faculties and institutes: Faculty of Technology, Novi Sad; Faculty of Chemistry, Faculty of Technology and Metallurgy and Faculty of Pharmacy from Belgrade, and Vinca Institute of Nuclear Sciences; Faculty of Sciences from Kragujevac.

PHYSICO-CHEMICAL CHARACTERIZATION OF NEWLY SYNTHESIZED COMPOUNDS

Members of the Research Group

- Dr Nada Perišić-Janjić, full professor, corresp. member of VANU
- Dr Tatjana Djaković-Sekulić, full professor
- Dr Sanja Podunavac-Kuzmanović, associate professor, Faculty of Technology, Novi Sad
- Dr Djendji Vaštag, assistant professor
- Dr Lidija Jevrić, teaching assistant, Faculty of Technology, Novi Sad
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Cooperation

- Faculty of Technology and Metallurgy, Belgrade,
- Faculty of Pharmacy, Belgrade,
- Faculty of Technology and Metallurgy, St. Cyril and Methodius University, Skopje, FYR Macedonia,
- Babes-Bolyai University, Faculty of Chemistry, Cluj-Napoca, Romania,
- Department of Planar Chromatography, Faculty of Chemistry, M. Curie-Sklodowska University, Lublin, Poland
- Silesian Academy of Medicine, Sosnowiec, Poland
- Department of Energy Saving and Air Protection, Central Mining Institute, Katowice, Poland

Other Activities

The team leader, Prof. Nada Perišić-Janjić, is a member of the Editorial Board of the international journal *Ultra Scientist of Physical Sciences*. Also, she has served as a referee for the following journals:

- Anal. Chem.
- J AOAC INT
- J. Chem. Soc. Pakistan
- Bull. Chem. Technol., Macedonia
- J. Serb. Chem. Soc.
- J. Chromatogr. A
- Heteroatom Chemistry
- J. of Separation Sciences

The Group is presently concerned with physico-chemical characterization of only newly synthesized compounds that are biologically active or exhibit potential biological activity. The emphasis is on the relationship between the physico-chemical characteristics (retention constant, acid-base constant, characteristic frequency of absorption maxima) of molecules and chemical structure, and also with biological activity of newly synthesized compounds.

Reversed-phase chromatography (RP-TLC or RP-HPTLC) is used to determine retention constants, which represent direct indicators of the lipophilicity of investigated compounds, that is they are directly related to the biological activity. Spectrophotometric method serves to determine acid-base constants of the newly synthesized compounds, as well as the effect of different organic solvents on the spectral characteristics of these compounds. These physico-chemical characteristics are also important in predicting biological activity of a given compound.

The Group began its activities in the first half of the 1960s under the guidance of Prof. Velimir Canić. From the very beginning a member of the Group was also Prof. Nada Perišić-Janjić, who is even today active and gathers around herself young researchers. During almost one half of a century of its existence the Group published original scientific papers from chromatography that have been well accepted and cited in numerous renowned journals and monographs. At the beginning, the works were of analytical significance, and later on began studies of retention characteristics of the chromatographic mechanism. Very soon, the Group has become known for using nonconventional supports (rice and corn starch, talc, cellulose, and an original support - aminoplast) in thin layer chromatography. In parallel with chromatography, Prof. Nada Perišić-Janjić has become involved in spectrophotometric study of acid-base equilibria in solutions, as well as of complex compounds with different ligands (most often newly synthesized organic molecules). Some of complex compounds appeared to be of high significance for analytical applications, so that the results were published in leading international journals and cited both in journals and renowned monographs.

The parallel work in two scientific areas have brought about the correlation of physico-chemical parameters determined by two different methods (spectrophotometry and chromatography), that is the linking of the retention and ionization constants. Using modern statistical software packages for experimental data treatment it was possible to derive a mathematical model relating the chemical structure to the molecule properties. Thus

the investigations attained a multidisciplinary character, with the emphasis on physico-chemical characterization of the newly synthesized compounds.

The current, both chromatographic and spectrophotometric, investigations are concerned with the design of biologically active substances. This represents a significant scientific contribution to the design of new drugs, insecticides, pesticides, and other biologically active substances.

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LEADING OF PROJECTS

- **Physico-chemical studies of newly synthesized biologically active compounds**
  Provincial Secretariat for Science and Technological Development: Program of significance for science and technological development of AP Vojvodina, international cooperation with Romania.
  Project No.: 114-451-00605/2005-01
  Duration: 2005 – 2007
  Project Leader: Prof. Nada Perišić-Janjić, Faculty of Sciences, Novi Sad.
- **Study of the effect of chemical structure and physico-chemical properties of newly synthesized compounds on their biological activity. Contribution to designing biologically active compounds.**
  Provincial Secretariat for Science and Technological Development: Program of significance for science and technological development of AP Vojvodina, international cooperation with Romania and Poland.
  Project No.: 114-451-01336/2007
  Duration: 2007 – 2008
  Project Leader: Prof. Nada Perišić-Janjić, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Study of the synthesis, structure and properties of organic compounds of natural and synthetic origin**
  Ministry of Science and Technological Development of the Republic of Serbia - Fundamental Research.
  Project No.: 1694
  Duration: 2000 – 2005
  Project Leader: Prof. Gordana Uščumlić, Faculty of Technology and Metallurgy, Belgrade
- **Study of the synthesis, structure and properties of organic compounds of natural and synthetic origin**
  Ministry of Science and Technological Development of the Republic of Serbia - Fundamental Research.
  Project No.: 142063.
  Duration: 2006 – 2010
  Project Leader: Prof. Gordana Uščumlić, Faculty of Technology and Metallurgy, Belgrade.

NATURAL RESOURCES OF BIOLOGICALLY AND PHARMACOLOGICALLY ACTIVE COMPOUNDS

The main research activity of the Group is focused on the study of biologically active compounds from cultivated and wild-grown plants and fungi. The research proceeds in the following directions:

1. Chemical analyses of extracts obtained from plants and fungi aimed at: (a) Chemical characterization of plants, i.e. the chemical correlation within a species of a certain genus with the aim of determining characteristic chemical types; (b) Chemical determination of plant extracts for assaying active constituents; (c) Isolation and determination of the structure of biologically active compounds from plants and fungi.
2. Biochemical studies: (a) Investigation and assessment of antioxidant activities of plant extracts and isolated compounds in different *in vitro* systems and identification of substances responsible for antioxidant (prooxidant) effect; (b) Study of the effect of the extracts on the different enzyme systems and selected biochemical parameters in blood and in the liver of experimental animals; (c) Introduction of new, modern *in vitro* tests to investigate anti-inflammatory action of officinal drugs, phytopreparations, and herbal extracts.
3. Pharmacological research: (a) *in vivo* study of selected herbal preparations and their interaction with drugs (effect on the CNS, analgesic effect, pharmacodynamic investigations, effect on the intestine flora, etc.); (b) Experimental pharmacological investigations of drugs *in vitro* and *in vivo.*
4. Microbiological studies: (a) Study of the antimicrobial and antifungal action of extracts from plants and fungi.

The research team offers its expertise in the domain of study of qualitative and quantitative composition of plant extracts and phytopreparations – issuing quality certificates (BIOSS – PS, Belgrade).

The most important instrumentation includes liquid chromatographs: HPLC-DAD, LC-MS (QQQ), multiscan spectrophotometer, centrifuge.

Research results of the Group have been verified through numerous publications in international journals, presentations at international scientific meetings, PhD and MS theses, review papers, national and international monographs, etc.

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2. Mimica-Dukić, N., Božin B. (2008) Mentha L. Species (Lamiaceae) as promising sources of bioactive secondary metabolites (2008) *Current Pharmaceutical Design*, 14, 3141-3150.

Members of the Research Group

- Dr Neda Mimica-Dukić, full professor
- Dr Mira Popović, full professor
- Ivana Beara, MS, teaching assistant
- Nataša Simin, MS, teaching assistant
- Emilija Jovin, researcher, PhD student
- Dejan Orčić, researcher, PhD student
- Marija Lesjak, PhD student
- Kristina Balog, senior technician
- Marina Franciškoviċ, PhD student

Apart from the Research Group from the Department of Chemistry, Biochemistry and Environmental Protection a number of associates from the Department of Biology and Ecology are also active research participants: Dr. Boža Pal, Dr. Ružica Igić, Dr. Goran Anačkov and Maja Karaman, MS, as well as Dr. Biljana Božin and Dr. Vesna Ivetić from the Faculty of Medicine in Novi Sad.

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Cooperation

At the national level, a fruitful cooperation has been established with the Faculty of Medicine in Novi Sad, Faculty of Biology in Belgrade, Josif Pančić Institute, Belgrade, Faculty of Pharmacy, Belgrade, Faculty of Technology, Novi Sad, Faculty of Medicine in Kosovska Mitrovica. The cooperation proceeds either through joint participation in research projects or through joint research and publications.

International cooperation is realized through joint research, exchange of young researchers and joint publications. It involves the following institutions: University of Athens, Department of Pharmacognosy and Natural Products, Athens, Greece; The School of Pharmacy, University of Reading, UK; University of Ljubljana, Faculty of Biotechnology, Slovenia.

Part of the Research Group concerned with biochemistry of medicinal herbs

3. Mimica-Dukić, N. andw M. Popović: Apiaceae Species. A Promising Sources of Pharmacologically Active Compounds I: Petrosellinum crispum, Apium greveolens and Pastinaca sativa. In *Recent Progress in Medicinal Plants.* Ed. J.N. Govil & V.K. Singh. Vol. 21: Phytopharmacology and Therapeutic Values III. Eds. V. K. Singh & J. N. Govil. Studium Press LLC, U.S.A 2007.
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OTHER ACTIVITIES

The Group leader, Prof. Neda Mimica-Dukić, is a member of the Editorial Board of the international journal *Phytotherapy Research*. She, as well as the other members of the Group are active reviewers for leading international journals: *Jornal of Agricultural and Food Chemistry, Food Chemistry, Phytotherapy Research, Planta Medica* and *Jornal of Medicinal Food.*

LEADING OF PROJECTS

- **Chemical characterization and biological activity of secondary biomolecules from plants and fungi and their interaction with xenobiotics**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 142036
  Duration: 2006-2010
  Project Leader: Prof. Neda Mimica-Dukić, Faculty of Sciences, Novi Sad.
  Project Participants: Faculty of Medicine, Faculty of Technology, and Faculty of Agriculture, University of Novi Sad.

PARTICIPATION IN PROJECTS

- **Search for new natural substances with antimicrobial action against bacterial infection carriers with a special emphasis on those causing miscarriages and premature births.**
  Provincial Secretariat for Science and Technological Development of AP Vojvodina.
  Duration: 2005-2009
  Project Leader: Prof. Mirjana Bogavac, Faculty of Medicine, Novi Sad
- **Fungi as a source of biologically active compounds**
  Bilateral cooperation with the Faculty of Biotechnology University of Ljubljana (Slovenia), supported by the Ministry of Science of the Republic of Serbia.
  The project lasted to 2007

Work on the HPLC-MS-MS instrument

Members of the Research Group

- Dr Svetlana Trivić, full professor
- Dr Mira Popović, full professor
- Dr Vladimir Leskovac, full professor (retired), Faculty of Technology, Novi Sad
- Dr Draginja Peričin, full professor, Faculty of Technology, Novi Sad
- Dr Mirjana Antov, associate professor, Faculty of Technology, Novi Sad
- Dr Julijan Kandrac, full professor, Faculty of Agriculture, Novi Sad
- Ljiljana Radulović, teaching assistant, Faculty of Technology, Novi Sad
- Senka Madjarev-Popović, PhD student, junior researcher, Faculty of Technology, Novi Sad
- Sanja Vlaisavljević, PhD student, junior researcher
- Jelena Plačkić, PhD student, junior researcher

ENZYMOLOGY

The research activities of the Group are oriented in the following directions: a) Study of the relationship between structure and function of enzymes (primarily of redox and hydrolytic enzymes) and the mechanism of their action; b) Development of aqueous two-phase systems (ATPS) and bioseparation techniques for the isolation and purification of hydrolytic enzymes of industrial importance, with the aim of their application in biotechnology; c) Study of the effects of xenobiotics (drugs) on antioxidant activity in model systems both under *in vitro* and *in vivo* conditions in the presence/absence of various extracts of herbal plants.

LEADING OF PROJECTS

- **Structure and function of redox and hydrolytic enzymes: Study of their action mechanism and some aspects of their application in biotechnology and medicine**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 142046
  Duration: 2006–2010
  Project Leader: Prof. Svetlana Trivić, Faculty of Sciences, Novi Sad
  The main objective of this research is to study the relationship between the structure and function of redox enzymes. The planned project topics are:
  (1) Study of the mechanism of redox enzymes, especially of alcohol (ES 1.1.1.1) and lactate dehydrogenase (EC 1.1.1.27) based on their three-dimensional structure; (2) Molecular modeling of active centers of these enzymes, to be established by crystallographers; (3) Study of the mechanism of action of the mentioned enzymes based on their kinetic isotopic effects; (4) Calculation of thermodynamic parameters of the reactions catalyzed by the given enzymes by Legendre transformations; (5) Study of the mechanism of mixed-function oxidases responsible for reductive mechanism of drugs from the class of artemisinins (to control malaria) by the methods of enzyme kinetics and identification of metabolites by analytical methods. Each particular part of the research project is to be checked by the methods of enzyme kinetics – research area in which this research team possesses special experience; (6) Study of the effect of xenobiotics (drugs) on antioxidant parameters and pharmacodynamic activity in model systems under both *in vitro* and *in vivo* conditions; (7) Effect of different extracts of medicinal herbs on the antioxidant parameters and phamacodynamic activity in model systems under *in vitro* and *in vivo* conditions in the presence /absence of xenobiotics (drugs).
  Another objective of the project is the developing of the ATPS and bioseparation techniques for the isolation and purification of hydrolytic enzymes of potential industrial significance with the aim of their application in biotechnology.

PARTICIPATION IN PROJECTS

- **Hydrolytic and redox enzymes from microorganisms: Study of the regulation of enzyme biosynthesis and action mechanism for industrial applications**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 1394
  Duration: 2002-2006
  Project Leader: Prof. Draginja Peričin, Faculty of Technology, Novi Sad.

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Cooperation

- Drug Discovery Unit, Orion Pharma, Espoo (Helsinki), Finland

NANO-FULLERENE DERIVATIVES – BIOLOGICAL STUDIES

This multidisciplinary research group is concerned with the study of biologically active nano-materials, fullerenes. The main research directions are the synthesis and physico-chemical determination of biologically active derivatives of fullerenes in nano formulations. Biological investigations *in vitro* encompass healthy and malignant human cells, pathogen microorganisms, genotoxicity and gene expression, morphological and subcellular changes, etc. Studies on *in vivo* models of nano-formulations of fullerene derivatives are concerned with acute and chronic toxicity, biochemical, pathohistological and subcellular changes in tissues in the function of protection of vital organs in chemo and radio therapies on acute and chronic models.

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Members of the Research Group

- Dr Aleksandar Djordjević, associate professor
- Dr Borut Štrukelj, full professor, Faculty of Pharmacy, Ljubljana (Slovenia)
- Dr Karmen Stankov, assistant professor, Faculty of Medicine, Novi Sad
- Dr Rade Injac, assistant professor, Faculty of Pharmacy, Ljubljana (Slovenia)
- Dr Gordana Bogdanović, Faculty of Medicine, Novi Sad
- Dr Višnja Bogdanović, Faculty of Medicine, Novi Sad
- Branislava Srdjenović, MS, Faculty of Medicine, Novi Sad
- Jasminka Mrdjanović, MS, Faculty of Medicine, Novi Sad
- Ivana Ičević
- Slavica Šolajić, Faculty of Medicine Novi Sad

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2. Injac Rade, Radić Nataša, Govedarica Biljana, Đorđevic Aleksandar, Strukelj Borut: Bioapplication and activity of fullerenol $C_{60}(OH)_{24}$, *African Journal of Biotechnology*, 7 (25): (2008) 4940-4050
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Cooperation

- Faculty of Pharmacy, Ljubljana (Slovenia)
- Faculty of Medicine, Ljubljana (Slovenia)
- Jožef Štefan Institute, Ljubljana (Slovenia)
- Dipartimento di Biochimica G. Moruzzi, Università di Bologna
- Institute of Oncology, Sremska Kamenica
- Military Medical Academy, Belgrade
- Vinca Institute of Nuclear Sciences, Belgrade
- Faculty of Medicine, Novi Sad

Equipment

Jeol SEM 6460 LV, Dynamic light scattering, Mastersizer 2000, FTIR Thermo-Nicolet, nexus 670, TG, DTG, DTA Du Pont 1090, X-ray diffractometer Philips, NMR Brücker, HPLC/MS Agilent, Flow citometry, real time qPCR, Fluorescence microscope.

LEADING OF PROJECTS

- **Chemical derivatization of fullerenes and biological studies**

  Ministry of Science and Environmental Protection of the Republic of Serbia

  Project No.: 1893

  Duration: 2000-2005

  Project Leader : Prof. Aleksandar Djordjević, Faculty of Sciences, Novi Sad.

  The study was concerned with the cytotoxicity of water-soluble derivatives of fullerene C_{60} against healthy and malignant cell lines. Also, it dealt with the antioxidant properties of these derivatives in chemical and biological model systems. The modulatory action of fullerenol $C_{60}(OH)_{24}$ was compared with that of Doxorubicin under in vitro conditions. Experiments also encompassed the intercalation of polar molecules into the crystalline structure of fullerene C_{60}.

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- **Synthesis of biologically active fullerene derivatives and nanomedical studies**

  Ministry of Science and Technological Development of the Republic of Serbia.

  Project No.: 142076

  Duration: 2006-2010

  Project Leader: Prof. Aleksandar Djordjević, Faculty of Sciences, Novi Sad.

  The objective is to study the polydentate properties of fullerenol with biogenic microelements, and their acute and subacute toxicity in mice. New radiopharmaceticals and nanoradiophar – maceuticals of fullerenol were synthesized and their pharmacodynamics was studied in vivo. Also, the study is concerned with fullerenol genotoxicity to human limphocytes, as well as with fullerenol radioprotectivity in both *in vitro* and *in vivo* models. Further, the study is carried out of the protective action of fullerenol in healthy and malignant *in vivo* models against acute and chronic action of Doxorubicin. The study also encompassed formulation of fullerenol nanoparticles in solution, and their biological effect was studied both *in vitro* and *in vivo*. On the basis of the obtained results it will be possible to explain the mechanism of fullerenol action in biological models.

DEVELOPMENT OF NEW PROCEDURES FOR MONITORING AND IMPROVEMENT OF THE ENVIRONMENT QUALITY

Scientific research activates of the Group are oriented in two directions:

1. Development of new and improvement of the existing analytical methods with the emphasis on the environment-friendly procedures, and
2. Development of new and improvement of the existing procedures for improvement of the environment quality.

The first research direction is concerned with the applicability of carbon-based electrodes such as, for example, boron-doped diamond, as potentiometric sensors on the example of argentometric titrations of active components of pharmaceutical products containing in their molecules ionically or covalently bonded halogen, as well as for the determination of pesticides. The results are compared with those obtained using a glassy carbon electrode undoped or doped with boron or phosphorus. When needed, the developed methods are applied to study the kinetics of photodegradation of pesticides. Also, the studies encompass the preparation and characterization (electrochemical and microscopic) of new surface-modified electrodes by depositing various films (Hg, Bi, Sb, Sn, Cu, Nafion, and their combinations) on the electrode surface. The possibilities are investigated for applying simple and sensitive procedures for the determination of selected pesticides and pharmaceuticals with electroactive functional groups, as well as their main degradation products, to assess the state of quality of samples (model systems and real samples). Along the same line, of the research interest is the possibility of the application of planar carbon-based electrodes (modified and unmodified) for the use in field analyses.

Besides, the research encompasses the development of chromatographic methods for the determination of selected herbicides (picloram, triclopyr, mecoprop, MCPA, etc.) and insecticides (triacloprid, etc.), as well as other biologically active substances. The developed methods are used to study the kinetics and mechanisms of photodegradation of these agents. Further, the research is concerned with the improvement of analytical procedures for the determination of mycotoxins fumonisins and deoxynivalenol. Special attention is paid to enhancing efficiency of their extraction and choosing environment-friendly extracting agents. Since the HPLC analysis is relatively time-consuming, the possibilities are investigated for applying infrared spectroscopy for the determination of these mycotoxins in cereals.

In the frame of the second direction the Group studies the efficiency of photocatalytic degradation in the presence of TiO_2 (doped and undoped) and some other semiconductors, applying UV and vis radiation for mineralization of the mentioned herbicides (triclopyr, picloram, clopiralid, mecoprop, MCPA, etc.), insecticides (imi-

Members of the Research Group

- Dr Biljana Abramović, full professor
- Dr Ferenc Gaál, full professor, corresp. member of VANU
- Dr Luka Bjelica, full professor
- Dr Valerija Gužvanj, assistant professor
- Daniela Šojić, MS, research associate
- Žigmond Pap, research associate
- Vesna Despotović, MS, research associate
- Sanja Kler, junior researcher
- Nemanja Banić, junior researcher

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Cooperation

The Group has developed fruitful cooperation with the Faculty of Agriculture, Novi Sad; Institute of Veterinary Medicine, Novi Sad, as well as with the Vinca Institute of Nuclear Sciences, Belgrade.
Of foreign institutions, intensive cooperation is currently pursued with the Research Group for Technical Analytical Chemistry, of the Hungarian Academy of Sciences, Budapest (Hungary); Department of Analytical Chemistry of the Faculty of Chemical Technology, Pardubice (Czech Republic) on the project CEEPUS II, as well as with the Laboratory for Environmental Studies of the University in Nova Gorica (Slovenia).
From this area the Group members have published up to now more than 100 scientific papers, of which the majority (more than 80) in international journals. Some of the Group members have acted as reviewers of papers for international journals.

Equipment

The Group has at its dsiposal all the basic instrumentation for the realization of its tasks.

Group members (from left to right): Biljana Abramović, Ferenc Gaál, Vesna Despotović, Sanja Kler, Luka Bjelica, Daniela Šojić, Ljiljana Jovanović, Žigmond Pap, Nemanja Banić and Valerija Gužvanj

dacloprid, acetamiprid, triaclor, etc.), as well as of selected biologically active components of pharmaceuticals that appear as frequent water contaminants. The kinetics and mechanism of photocatalytic degradation are studied by the previously developed electroanalytical, chromatographic methods with DAD and MS/MS detection, as well as by spectrophotometric, ionochromatographic, TOC, and other methods.

LEADING OF PROJECTS

- **Study of regional water resources in the function of sustainable development**
  European Agency for Reconstruction through the Ministry of International Economic Relations within the Neighboring Program Hungary-Serbia (2006-2008); Grant No. 04SER02/01/009
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Project partners from Serbia: Faculty of Technical Sciences, Novi Sad; Faculty of Technology, Novi Sad, and Provincial Secretariat for Environmental Protection and Sustainable Development of AP Vojvodina.
- **Analytical chemistry and degradation of neonicotionids**
  Bilateral project of the Republic Serbia and Montenegro and Republic of Slovenia; Project No.: 337-00-167/2006-01/10 (2006-2008)
  Project Leader from Serbia: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Partner on the project: University (Polytechnics) in Nova Gorica, Laboratory for Environmental Research, Nova Gorica, Slovenia.
- **Development of new and improvement of the existing procedures for monitoring and improvement of the environment quality**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: ON142029
  Project Leader: Prof. Biljana Abramović, Faculty of Sciences, Novi Sad
  Partners: Faculty of Agriculture and Institute of Veterinary Medicine, Novi Sad
- **Development of chemical analytical methods for the analyses of neonicotinoids and derivatives of pyridine-carboxylic acid**
  Provincial Secretariat for Science and Technological Development of AP Vojvodina; Project No.: 114-451-00604/2005-1

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'Great Expectation': What is going to emerge on the display of the liquid chromatograph? Young researchers: Vesna Despotović, Daniela Šojić, Sanja Kler and Nemanja Banić (from left to right)

Project Leader: Prof. Ferenc Gaál, Faculty of Science, Novi Sad
Partner: Vojvodina Academy of Sciences and Arts, Novi Sad.

- **Development of new and improvement of existing analytical methods and techniques for monitoring the environment quality**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: 1622; Duration: 2002-2004 and 2005
  Project Leader: Prof. Ferenc Gaál. Faculty of Sciences, Novi Sad
  Partners: Faculty of Agriculture and Institute of Veterinary Medicine, Novi Sad.
- **Development of a new composition, structure and preparation mode of concentrated pelletized fish feed**
  Federal Ministry of Development, Science and Environment; Project No.: TCI-395; Duration: 1996–2000
  Project Leader: Prof. Ferenc Gaál. Faculty of Sciences, Novi Sad
  Partners: Scientific Institute of Veterinary Medicine of Serbia and Carnex, Vitamix Feed Manufacturer, Vrbas.
- **Development of new structure and composition of complete feed mixture for carp farm breeding**
  Federal Ministry of Science, Technology and Development (1993).
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Partners: Vitamix, Feed Manufacturer, Vrbas.
- **Development and application of methods of chemical analysis**
  Ministry of Science and Technology of the Republic of Serbia;
  Project duration: 1996–2000.
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Partners: Copper Institute Bor and Faculty of Philosophy, Niš.
- **Development and application of methods of chemical analysis**
  Ministry of Science and Technology of the Republic of Serbia
  Duration 1991-1995
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad

Partner: Faculty of Technology, Novi Sad.

- **Development and application of methods of chemical analysis**
  Research Fund of Vojvodina (1986-1990).
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Partner: Faculty of Technology, Novi Sad
- **Improvement of analytical methods and construction of appropriate instruments**
  Research Fund of Vojvodina (1982-1986).
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences
  Partner: Faculty of Technology, Novi Sad
- **New analytical methods for determining basic products of the chemical industry**
  Research Fund of Vojvodina (1981).
  Project Leader: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Partner: Faculty of Technology, Novi Sad
- **New analytical methods for determining basic products of the chemical industry,**
  Research Fund of Vojvodina (1976-1980).
  Project Leader: Prof. Velimir Canić, Faculty of Sciences and Faculty of Technology
  Partners: Faculty of Technology and Faculty of Agriculture, Novi Sad

PARTICIPATION IN PROJECTS

- **Teaching modern analytical and bioanalytical methods**
  Central European Exchange Program for University Studies, CII-CZ-0212-01-0708, i.e. CII-CZ-0212-02-0809 (2007-).
  Project Leader: Prof. Karel Vytřas, University of Pardubice, Pardubice (Czech Republic)
  Coordinator for Serbia: Prof. Ferenc Gaál, Faculty of Sciences, Novi Sad
  Participants, University of Novi Sad, University of Pardubice, (Czech Republic); AGH – University of Krakow (Poland); KF University, Graz, (Austria); University of Technology and Economics, Budapest (Hungary); University of Zagreb, (Croatia); St Cyril-Methodius University, Skopje (FYR Macedonia); Transylvania University of Brasov (Romania).
- **Air pollution - project in the frame of the macroproject Environmental Protection, Theme: "Development of chemical-technological procedures for reducing air pollution in phosphoric acid production**
  Research Fund of Vojvodina (1988-1991)
- **Analytical investigations in the industry of synthetic polymers of significance to SAP Vojvodina, Theme in the subproject "Research and development of chemistry, technology and application of polymers in the oil, chemical and petrochemical industries"**
  Research Fund of Vojvodina (1986).
  Subproject Leader: Prof. Zoran Petrović, Faculty of Technology, Novi Sad
- **Studies in the area of air pollution and its control, Subproject in the frame of the project "Studies in the area of processing and purification of industrial wastewaters and control of air pollution"**
  Research Fund of Vojvodina (1984-1986).
  Subproject Leader: Prof. Miroslav Kosanić, Faculty of Sciences, Novi Sad

18. Abramović, B.F., Jakšić, S.M., Mašić, Z.S.: "Liquid chromatographic determination of fumonisins B_1 and B_2 in corn samples after reusable immunoaffinity column clean-up", *J. Serb. Chem. Soc.*, 70, 899-910 (2005).
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21. Abramović, B. F., Anderluh, V. B., Topalov, A. S., Gaál, F. F.: "Titanium dioxide mediated photocatalytic degradation of 3-amino-2-chloropyridine", *Appl. Catal. B: Environ.*, 48, 213-221 (2004).
22. Topalov, A., Molnár-Gábor, D., Abramović, B., Korom, S., Peričin, D.: "Photocatalytic removal of the insecticide fenitrothion from water sensitized with TiO_2", *J. Photochem. Photobiol. A*: Chem., 160, 195-201 (2003).
23. Abramović, B. F., Bjelica, L. J., Gaál, F. F., Guzsvány, V. J., Jovanović, Lj. S.: "Some electrochemical characteristics of boron- and phosphorus-doped glassy carbon electrodes", *Electroanal.*, 15, 878-884 (2003).

Services

For a number of years the Group has provided services in the domain of determining composition of various materials, as well as in preparation of studies on organization of chemical quality control, either independently or in cooperation with the interested institutions or individuals. Also, the Group members offer their expertise concerning construction and equipping of laboratories of different profiles.

Members of the Research Group

- Dr Katarina M. Penov Gaši, full professor
- Dr Evgenija A. Djurendić, full professor
- Dr Marija N. Sakač, full professor
- Dr Janoš J. Čanadi, full professor
- Dr Slobodanka M. Stanković, full professor, Department of Physics
- Dr Olivera R. Klisurić, assistant professor, Department of Physics
- Suzana S. Jovanović-Šanta, MS, teaching assistant
- Andrea R. Gaković, MS, teaching assistant
- Jovana J. Daljev Ajduković, MS, research associate
- Marina P. Zaviš, MS, research associate
- Aleksandar M. Oklješa, junior researcher

SYNTHESIS OF BIOLOGICALLY ACTIVE ORGANIC COMPOUNDS

Research of this team is concerned with the synthesis of new derivatives of steroid compounds, first of all androgenic and estrogenic hormones, with the aim of obtaining anthihormones that inhibit enzymes involved in the steroidogenesis, then antitumor agents as well as of antioxidants. Besides, the research subject is the synthesis of selected mono- and bis-ester and amide derivatives of phenol-type nonsteroidal compounds as antioxidants and antitumor agents. Finally, the researchers are also involved in phisico-chemical studies of the newly prepared compounds.

LEADING OF PROJECTS

- **Synthesis and physico-chemical study of selected organic compounds of potential pharmacological importance**
  Ministry of Science and Technological Devlopment of the Republis of Serbia
  Duration: 2006-2010
  Project Leader: Prof. Marija Sakač, Faculty of Sciences, Novi Sad

SELECTED REFERENCES

1. S. Jovanović-Šanta, J. Petrović, M. Sakač, Z. Žakula, E. Isenović, N. Ribarac-Stepić, The influence of 17-oxo- and 17-hydroxy-16,17-secoestratriene derivatives on estrogen receptor, *Collect. Czech. Chem. Commun.*, **71**, 532-542 (2006).
2. K. Penov Gaši, M. Đurendić Brenesel, E. Đurendić, M. Sakač, J. Čanadi, J. Daljev, T. Armbruster, S. Andrić, D. Sladić, T. Božić, I. Novaković, Z. Juranić, Synthesis and biological evaluation of some 17-picolyl and 17-picolinylidene androst-5-ene, *Steroids*, **72**, 31-40 (2007).
3. D.Lazar, O. Klisurić, S. Stanković, K. Penov Gaši, Lj. Medić Mijačević, M. Sakač, R. Kovačević, C. Courseille, D-Secoestrone derivatives. VII[1] 3-Methoxy-17-keto-17-benzyl-16,17-secoestra-1,3,5(10)-trien-16-nitrile and (17S) 3-Methoxy-17-hydroxy-17-benzyl-16,17-secoestra-1,3,5(10)-trien-16-nitrile, *Z. Kristallogr.*, **222**, 244-248 (2007).
4. M. Sakač, K. Penov Gaši, E. Đurendić, S. Andrić, D. Miljković, Synthesis and biological evaluation of 17-[4-(2-aminoethoxy)phenyl]-16,17-secoestra-1,3,5(10)-triene derivatives, *Collect. Czech. Chem. Commun.*, **72**, 403-410 (2007).
5. E. Đurendić, J. Daljev, M. Sakač, J. Čanadi, S. Jovanović-Šanta, S. Andrić, O. Klisurić, V. Kojić, G. Bogdanović, M. Đurendić Brenesel, S. Novaković, K. Penov Gaši, Synthesis of some epoxy and/or N-oxy 17-picolyl and 17-picolinylidene-androst-5-ene derivatives and evaluation of their biological activity, *Steroids*, **73**, 129-138 (2008).

Group members (from left to right), sitting: E. Djurendić, S. Stanković, K. Penov Gaši; standing: M. Zaviš, J. Ajduković, A. Gaković, A. Oklješa, S. Jovanović-Šanta, M. Sakač, J. Čanadi, O. Klisurić

6. E. Đurendić, M. Sakač, M. Zaviš, A. Gaković, J. Čanadi, S. Andrić, O. Klisurić, V. Kojić, G. Bogdanović, K. Penov Gaši, Synthesis and biological evaluation of some new A,B-ring modified steroidal D-lactones, *Steroids*, **73**, 681-688 (2008).
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Cooperation

- Institute of Oncology, Sremska Kamenica
- Faculty of Chemistry, Belgrade

Members of the Research Group

- Dr Aleksandar Nikolić, full professor
- Branislav Jović, MS, teaching assistant

Contact Person

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SPECTROSCOPIC STUDY OF HYDROGEN BOND

The research of the Group is focused on spectroscopic and thermodynamic study of intermolecular interactions and hydrogen bonds of N-substituted amides. The subject is of great scientific interest because of the importance of hydrogen bonds in biological systems. Because of great importance of proteins in biological systems great attention is paid to the study of the structure and interaction of N-substituted amides since they can serve as a simple model of biological systems with peptide bonds.

The research team of the Chair of Physical Chemistry studies characteristics of hydrogen bonds of the N-H protons on the basis of spectroscopic measurements (IR, NIR and ^{1}H NMR) and thermodynamic measurements (Densitometry).

LEADING OF PROJECTS

- **Physico-chemical research from theoretical and practical aspects**
  Program of significance for science and technological development of AP Vojvodina
  Project No,: 01-1153/1
  Duration: 1986 – 1990
  Project Leader: Prof. Aleksandar Nikolić, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Study of the synthesis, structure and properties of organic compounds of natural and synthetic origin**
  Fundamental Research; Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 1694
  Duration: 2000 – 2005
  Project Leader: Prof. Slobodan Petrović, Faculty of Technology and Metallurgy, Belgrade

SELECTED REFERENCES

1. A. Nikolic, B. Jovic, V. Krstic, J. Trickovic: N–H...O hydrogen bonding. FT-IR, NIR and 1H NMR study of N-methylpropionamide – Dialkyl ether systems *J.Mol. Struct.* 889 (2008) 328-331.
2. Nikolić, B. Jović, S. Csanady, S. Petrovic, N-H--O hydrogen bonding: FT IR, NIR and ^{1}HNMR study of N-Methylpropionamide-Cyclic ether systems , *J.Mol. Struct.* 834-836 (2007) 249-252.
3. Nikolić, B. Jović, V. Krstić, J. Tričković, J., Excess molar volumes of N-methylformamide + tetrahydropyran, + 2-pentanone, n-propylacetate at the temperatures between 298.15 K and 313.15 K *J. Mol. Liquids*, 133 (2006) 39-42.

4. Nikolić, A., Gobor, L., Krstić,V., Petrović,S., Excess molar volumes of N-methylacetamide + tetrahydrofuran, +2-butanone, +ethylacetate at the temperatures between 303.15 K and 318.5 K, *J. Mol.Liquids* 121, 139-142 (2005).
5. A. Nikolić , B. Jović, E. Davidović and S.Petrović, N-H...O Hydrogen Bonding. FT IR, NIR Study of N-methylformamide - Ether Systems XXIX European Congres of Molecular Spectroscopy, Opatia Croatia 3-8 Sep 2008 .
6. A. Nikolić, B. Jović, S. Csanady, S. Petrovic, N-H--O hydrogen bonding: FT IR, NIR and ^{1}HNMR study of N- Methylpropionamide-Cyclic ether systems XXVIII European Congres of Molecular Spectroscopy, Istanbul Turkey, 3-8 Sep 2006

Equipment

- FTIR/NIR Spectrophotometer Nexus 670, Thermo-Nicolet, USA
- Densitometer DE 40 Mettler Toledo, Japan

TOTAL SYNTHESIS OF NATURAL PRODUCTS AND MEDICINAL CHEMISTRY

Members of the Research Group

- Dr Velimir Popsavin, full professor
- Dr Mirjana Popsavin, full professor
- Goran Benedeković, MS, research associate
- Miloš Svirčev, MS, research associate
- Bojana Srećo, research associate
- Jovana Francuz, research associate,
- Ružica Marušić, senior technician

Contact Person

Velimir Popsavin
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Equipment

- Bruker AC 250 E NMR spectrometer

Bruker AC 250 E NMR Spectrometer (Opearator: Prof. Mirjana Popsavin)

Studies of the Group are focused on the development of new procedures of total synthesis of natural cytotoxic lactones and their analogues, as well as on *de novo* synthesis of potential bioisoesters of the known antineoplastic C-nucleoside thiazofurine. Besides, the research encompasses *in vitro* studies of the antiproliferative activity of the synthesized compounds against cell lines of selected human tumors and leukemias.

SELECTED REFERENCES

1. V. Popsavin, B. Srećo, G. Benedeković, M. Popsavin, J. Francuz, V. Kojić and G. Bogdanović: "Design, synthesis and antiproliferative activity of two new heteroannelated (–)-muricatacin mimics", *Bioorganic & Medicinal Chemistry Letters,* 2008, 18, 5181.
2. V. Popsavin, G. Benedeković, B. Srećo, M. Popsavin, J. Francuz, V. Kojić and G. Bogdanović: "Synthesis and antiproliferative activity of unnatural enantiomers of 7-*epi*-goniofufurone and crassalactone C", *Bioorganic & Medicinal Chemistry Letters*, 2008, 18, 5177.
3. V. Popsavin, G. Benedeković, B. Srećo, M. Popsavin, J. Francuz, V. Kojić, G. Bogdanović: "Divergent synthesis of cytotoxic styryl lactones from D-xylose. The first total synthesis of (+)-crassalactone C", *Organic Letters*, 2007, 9, 4235.
4. M. Popsavin, S. Spaić, M. Svirčev, V. Kojić, G. Bogdanović, V. Popsavin: "Synthesis and antitumour activity of new tiazofurin analogues bearing a 2,3-anhydro functionality in the furanose ring", *Bioorganic & Medicinal Chemistry Letters*, 2007, 17, 4123.
5. V. Popsavin, I. Krstić, M. Popsavin, B. Srećo, G. Benedeković, V. Kojić, G. Bogdanović: "Enantiodivergent synthesis of muricatacin related lactones from D-xylose based on the latent symmetry concept. Preparation of two novel cytotoxic (+)- and (–)-muricatacin 7-oxa analogues", *Tetrahedron*, 2006, 62, 4123.
6. M. Popsavin, S. Spaić, M. Svirčev, V. Kojić, G. Bogdanović, V. Popsavin: "2-(3-Amino-3-deoxy-β-D-xylofuranosyl)thiazole-4-carboxamide: A new tiazofurin analogue with potent antitumour activity", *Bioorganic & Medicinal Chemistry Letters*, 2006, 16, 5317.
7. M. Popsavin, Lj. Torović, M. Svirčev, V. Kojić, G. Bogdanović, V. Popsavin: "Synthesis and antiproliferative activity of two new tiazofurin analogues with 2'-amido functionalities", *Bioorganic & Medicinal Chemistry Letters*, 2006, 16, 2773.
8. V. Popsavin, B. Srećo, I. Krstić, M. Popsavin, V. Kojić, G. Bogdanović: "Synthesis and antitumour activity of muricatacin and goniofufurone analogues", *European Journal of Medicinal Chemistry*, 2006, 41, 1217.

Members of the Research Group (from left to right); upper row: Bojana Srećo, Goran Benedeković, Jovana Francuz, Velimir Popsavin and Miloš Svirčev; lower row: Ružica Marušić and Mirjana Popsavin

9. V. Pejanović, V. Piperski, D. Uglješić-Kilibarda, J. Tasić, M. Dačević, Lj. Medić-Mijačević, E. Gunić, M. Popsavin, V. Popsavin: "Synthesis and biological activity of some new 5'-O-acyl tiazofurin derivatives", *European Journal of Medicinal Chemistry*, 2006, 41, 503.
10. V. Popsavin, G. Benedeković, M. Popsavin, B. Srećo, D. Djoković: "Regiochemistry of epoxide ring opening in methyl 2,3-anhydro-4-azido-4-deoxy-α- and β-L-lyxopyranosides", *Carbohydrate Research*, 2005, 340, 1866.
11. V. Popsavin, S. Grabež, M. Popsavin, I. Krstić, V. Kojić, G. Bogdanović, V. Divjaković: "Wittig reaction with partially protected sugar lactol derivatives. Preparation of highly cytotoxic goniofufurone analogues", *Tetrahedron Letters*, 2004, 45, 9409.
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LEADING OF PROJECTS

- **Synthesis of selected biologically active molecules and analogues of potential interest for biomedicine and agronomy**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 142005.
  Duration: 2006–2010
  Project Leader: Prof. Velimir Popsavin, Faculty of Sciences, Novi Sad.

Members of the Research Group

- Dr Božo Dalmacija, full professor
- Dr Zagorka Tamaš, full professor
- Dr Elvira Karlović, full professor
- Dr Mile Klašnja, full professor, Faculty of Technology, Novi Sad
- Dr Olga Petrović, full professor
- Dr Milan Matavulj, full professor
- Dr Ivana Ivančev-Tumbas, full professor
- Dr Jasmina Agbaba, assistant professor
- Dr Milena Bečelić, assistant professor
- Dr Srdjan Rončević, assistant professor
- Dr Miljana Prica, assistant professor, Faculty of Technical Sciences, Novi Sad
- Dr Jelena Tričković, teaching assistant
- Dejan Krčmar, MS, teaching assistant
- Vesna Pešić, MS, research associate
- Malcolm Watson, MS, research associate
- Aleksandra Tubić, BS, research associate
- Snežana Maletić, BS, research associate
- Svetlana Ugarčina-Perović, BS, junior researcher
- Milena Dalmacija, BS, junior researcher
- Jelena Molnar, BS, junior researcher
- Ljiljana Božović, BS, junior researcher
- Alpar Barši, BS, junior researcher
- Marijana Kragulj, BS, junior researcher
- Sofija Poguberović, BS, junior researcher
- Ljubomir Murgul, senior technician
- Marijana Rajačić, senior technician
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ENVIRONMENTAL PROTECTION

Development of Quality Control Systems and Improvement of Processes

The research in the area of Environmental Protection in a narrower sense began almost thirty years ago, when Prof. Živojin Živanov laid foundation of the activities related to Environmental Chemistry at the Faculty of Sciences. The development of activities in this area in the last two decades has proceeded under the guidance of Prof. Božo Dalmacija. The core of the research team makes four full professors and three assistant professors, who lead research in several directions:

1. **Production and quality of drinking water**, with a special emphasis on the study of the behavior of natural organic matter in the process of drinking water preparation, removal of arsenic, removal of organic xenobiotics, formation of disinfection byproducts in the course of water production and distribution, optimization and investigation of the possibilities of the improvement of conventional and development of new treatment procedures (improved oxidation processes, membrane filtration), as well as the water quality characterization in the sense of its influence on the choice of wa-

ter treatment technology. In the last ten years three projects have been prepared aiming at the optimization of technological solutions of drinking water preparation in the course of at least one year, and in accordance with the world practice, in which investigations have been carried out by applying different combinations of drinking water preparation procedures exceeding laboratory capacities, at the semi-industrial pilot-plant setups of capacities above 2 m3/h. Studies have been carried out in Serbia (for the needs of waterworks in Kikinda and Zrenjanin) and in Bosnia and Herzegovina (Banja Luka waterworks). Significant results have been achieved in the area of adsorption of natural organic matter and xenobiotics on various adsorbents (optimization of activated carbon, optimization of contact filtration, application of biologically activated carbons, application of ion-exchange resins), in the area of optimization of the processes of coagulation and flocculation for the purpose of removal of undesired water components, as well as characterization of the oxidation processes using various oxidation agents (ozone, chlorine dioxide, chlorine), along with the qualitative and quantitative analyses of disinfection byproducts.

2. **Water resources management**, in the frame of which investigations are concerned with the monitoring of wastewater quality and preparation of the registry of polluters. The data about wastewater quality and loads of water bodies have been collected in the course of the last ten years. In this research domain a methodology has been worked out for the determination of water use allowance to industrial tenants (to the Public Water Management Com-

Members of the Research Group (from left to right): Vesna Pešić, Svetlana Ugarčina-Perović, Aleksandra Tubić, Jasmina Agbaba, Srdjan Rončević, Snežana Maletić, Malcom Watson, Elvira Karlović, Ivana Ivančev-Tumbas, Zagorka Tamaš, Božo Dalmacija

Cooperation

Cooperation with foreign experts and institutions and international organizations is realized through joint projects and activities with UNEP, Swiss Organization for Development and Cooperation (SDC, Belgrade), Norwegian Institute for Water Research (NIVA), University in Wageningen (Netherlands), CUTEC Institute (Clausthal, Germany), Fraunhofer Institute for Technology Development (Stuttgart, Germany), Italian National Agency for New Technologies (ENEA), DHV (Netherland), Oxford University from Oxford (Great Britain), University from Aberdeen (Great Britain) and Institute for Energy and Process Engineering in Environmental Protection/Water Technology from the University Duisburg-Essen (Duisburg, Germany). The researchers of the Group make part of a research network established in the frame of the COST Action 636 "Xenobiotics in the Urban Water Cycle". At the national level, the Group has a fruitful cooperation with a number of academic institutions within the University of Novi Sad and Belgrade, and with the Institute of Water Resources Management "Jaroslav Černi". The Group members are active in a number of international and national associations and organizations: Serbian Chemical Society, Serbian Society for Water Protection, Society for Water Technology and Sanitary Engineering, Yugoslav Association for Water Legislation, German Chemical Society (GDCh, Wasserchemische Gesellschaft), International Water Association (IWA), German Association for Water, Wastewater and Wastes (DWA). Professors, from the Group are members of editorial boards of national and reviewers of international journals, members of editorial boards of domestic conferences and scientific committees of international conferences, and bearers of public signs of recognition.

Equipment

Most modern instruments for the determination of organic and inorganic environmental pollutants have been acquired through the realization of national and international projects or from the fund of the National Investment Program (NIP) or through donations. These are: Gas chromatograph (GC) with diverse possibilities of detection (mass detector – MS, flame-ionization detector – FID, electron capture detector – μECD) and a special system for sample injection (purge & trap); total organic carbon (TOC) analyzer with IR detector; instrument with inductively-coupled plasma (ICP) with mass detection (ICP/MS); instrument for atomic absorption spectroscopy (AAS) with graphite, hydride and flame technique; instrument for ionic chormatography (IC) for simultaneous analysis of anions and cations with conductometric and UV detectors; infrared spectrophotometer with Fourier transformation (FTIR). The Laboratory is especially equipped for (surface and ground) water sampling, for automated wastewater sampling and physical characterization of sediments.

pany "Vojvodina Waters"). Apart from wastewaters, studies also encompass quality of particular stretches of ambiental waters and sediments.

3. **Improvement of treatment technologies of wastewaters** (municipal and industrial) with a special emphasis on the removal of specific contaminants (metals, oil pollution, phenols) and joint treatment of municipal and industrial wastewaters.
4. **Studies of wastewater treatment technologies** with a special emphasis on stabilization of industrial sludges (from the galvanizing industry, food processing industry, sludges generated in the water treatment processes). The possibilities and limitations are investigated of how to immobilize galvanic sludge by its incorporation into clay-based silicate materials, encompassing the effect of processing parameters such as thermal treatment temperature, relative content of sludge and physico-chemical characteristics of the matrix at the level of binding of the relevant metals in thermally treated material, leaching tests, testing of prepared construction materials, study of the stabilization process of the arsenic-rich flocculation sludge formed in the process of drinking water preparation, with the aim of its safe disposal. Study of the process of anaerobic degradation of solid wastes from the agroindustry (breweries, oil factories, sugar mills) with the aim of obtaining high-quality biogas in respect of methane content and anaerobic sludge with low content of organic matter compared to the total content of nitrogen components, which, after stabilization, could be used for soil conditioning.
5. **Monitoring and remediation of contaminated locations**, in the frame of which is investigated the behavior of oil pollution of the environment and the possibility of sanation of polluted areas by applying remediation, especially phytoremediation. In the research focus are the processes of biodegradation and biotransformation of hydrocarbons in contaminated soil and the determination of kinetic parameters of their degradation, comparison of chemical and microbiological quality parameters and the determination of functional relationships as well as limiting tolerated concentration, along with the assessment of passive bioremediation. Studies are oriented in the direction of the development of bioremediation techniques for soil decontamination to a level which would allow its safe disposal or reuse, intensification of bioremediation processes in contaminated soil and groundwater by utilizing microorganisms adapted by ecological engineering. Remediation research encompasses improvement of the processes of immobilization of metals in contaminated sediment (solidification and stabilization – brick manufacturing, adding of modified zeolites, hydoxyapatite, cement, calcium oxide, and study of the efficiency of sediment immobilization in sanitary depots with the aim of reducing ecological risks), study of electrokinetic separation of metals from the contaminated sediment. A special research direction represent studies of sorption processes in sediments, which encompass specific physico-chemical interactions of organic and inorganic pollutants that are significant for the risk assessment and remediation process. Analytical methods are being developed for sediment characterization and investigation of bioavailability contaminating matter through the determination of the content of acidic volatile sulfides and simultaneously extracted metals, sequential extraction of metals and adsorption on resins.

The new knowledge acquired in the frame of scientific research finds its application in the modernization of the process of teaching students majoring in the area of environmental protection as well as in the program intended for the

Students doing their diploma works

professionals from economy branches through the realization of School of Environmental Protection, which, in the course of 12 years of its existence, have attended about 100 participants from the country and from abroad.

Scientific investigations have been realized through more than 60 projects in cooperation with domestic scientific institutions, companies, international organizations and foreign universities and scientific institutes.

In addition to the solutions directly applicable in the industry, the output of the Group consists of more than 110 scientific papers in the international and domestic journals, 114 chapters in books, and more than 300 contributions presented at the domestic and international conferences. A number of selected papers have been published in leading international journals.

LEADING OF PROJECTS

- **Reinforcement of the laboratory for environmental protection at the University of Novi Sad, Faculty of Science as a centre of excellence for environmental chemistry and risk assessment (www.cecra.ih.ns.ac.yu)**
  The project is financed from the Sixth Framework Programme (FP6) of the European Union. In the frame of the project, the Department of Chemistry, Biochemistry and Environmental Protection of the Faculty of Sciences cooperates with Fraunhofer-Gesellschaft, Germany; University of Oxford, Department of Earth Sciences, Great Britain; Clausthaler Umwelttechnik Institut GmbH, Germany.
  Project No.: 043741; Duration: 2007-2009
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.
- **Arsenic and pesticides removal from natural water by an effective, safe and compact-sized separation system**
  EUREKA project in cooperation with ELKEDE - Greece, ENNEA - Italy, LIMNOS - Slovenia, ECOIND - Romania and the Public Municipal Company, Waterworks and Sewerage, Zrenjanin.
  Project No.: E! 3644; Project Duration: 2006-2009
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.

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  Ministry of Science and Technological Development of the Republic of Serbia
  Project Duration: 2008-2010
  Project Leader: Dr Srdjan Rončević, Faculty of Sciences, Novi Sad.
- **Development of remediation techniques for contaminated locations**
  Ministry of Science and Environmental Protection; Technological Development, Biotechnology.
  Project No.: 6867b; Project Duration: 2005-2007
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.
- **Development of a system of water quality control and improvement of the process of water protection (ON142058)**
  Ministry of Science and Environmental Protection, Fundamental Research
  Project duration: 2006-2010
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad
- **Bioremediation of soils and groundwaters contaminated with oil and oil derivatives**
  Ministry of Science and Environmental Protection; Fundamental Research
  Project No.: 101937; Project Duration: 2002-2005
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Cost-effective technologies for wastewater treatment and waste biodegradation in agro-industries with reclamation of resources**
  The project was financed from the Fifth Framework Programme (FP5) of the European Union; RTD project; INCO-COPERNICUS-Balkans A2; Partners: Wageningen University, The Netherlands; CUTEC Institute, Germany; ENEA Italy; Hydroinstitute Bijeljina; HEIS-Sarajevo, Bosnia and Herzegovina.

Pilot plant for drinking water preparation

Laboratory for gas chromatography

Project No.: ICA2-CT-2002-10010; Project Duration: 2003-2005
National Coordinator: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.

- **Monitoring of Groundwaters in the HIP Petrohemija, Pančevo**
  Faculty of Sciences in cooperation with Swiss Agency for Development and Cooperation (SDC) as the ordering party; Poject A5
  Project No.: 04-01-150/1; Project Duration: 2003
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.
- **Monitoring of Groundwater in Novi Sad**
  Project A2 in cooperation with the Public Communal Companny "Vodovod i kanalizacija" Novi Sad and Swiss Agency for Development and Cooperation.
  Project No.: 2003-1; Project Duration: 2003
  Project Leaders: Prof. Božo Dalmacija and Prof. Ivana Ivančev-Tumbas, Faculty of Sciences, Novi Sad.
- **Feasibility Study for Reconstruction and Rehabilitation of the Begej Canal**
  Faculty of Sciences in cooperation with the Provincial Secretariat for Environmental Protection and Sustainable Development and DHV from the Netherlands.
  Project No.: 0601-77/43; Project Duration: 2003
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad
- **Monitoring of water quality needed for the realization of the project of the revitalization of the Veliki Kanal and preparation for installing modern equipment for wastewater treatment for the towns and industry in Bačka**
  Faculty of Sciences in cooperation with the Norwegian Institute for Water Resarach (NIVA). Ordering Party: NECW-Renesansa
  Project No.: 04-01-1290/1; Project Duration: 2004
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences.
- **Groundwater Monitoring in the Novi Sad Oil Refinery**
  Faculty of Sciences in cooperation with the Public Communal Company "Vodovod i kanalizacija" Novi Sad and UNEP-UNOPS
  Project No.: C01/YUGR71-008; Project Duration: 2001-2003
  Project Leader: Prof. Božo Dalmacija, Faculty of Sciences, Novi Sad.

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International Cooperation

International cooperation is one of the most important activities of the Center. A great number of world known mathematicians were guests of the Department of Mathematics and Informatics, and lectured in the Center. Also, members of the Center visited some of the most renowned institutions and delivered their lectures.

Especially fruitful cooperation has been established with the colleagues from the Faculty of Mathematics of Turin University (Italy) and Faculty of Mathematics of the University of Vienna (Austria), where several associates of the Center defended their PhD theses. Exchanges in the frame of scientific visits of students and professors take place regularly each year. Of special importance is also the cooperation with colleagues from Campinas University (Brazil) and University Paris 7 (France).

CENTER OF EXCELLENCE FOR MATHEMATICAL STUDY OF NONLINEAR PHENOMENA

The Center of Excellence for Mathematical Study of Nonlinear Phenomena was granted the status of a center of excellence by the decision of National Council for Science and Ministry of Science and Technological Development of the Republic of Serbia in May of 2008, based on the proposal of the Accreditation Commission of the Ministry.

Research activity of the Center is primarily scientific, and it unites the work of three research groups at the Department of Mathematics and Informatics:

- *Group for Analysis, Probability and Geometry,*
- *Group for Numerical Mathematics,* and
- *Group for Forcing, Model Theory and Set-theoretical Logic.*

The work of the Center is realized through scientific and other projects, international cooperation, organizing seminars and scientific meetings, and work with young researchers. The Center has also an important role in the organization of courses in the frame of doctoral studies at the University of Novi Sad.

The Center was founded by Prof. Stevan Pilipović, Corresp. Member of the Serbian Academy of Sciences and Arts, Prof. Nataša Krejić and Prof. Miloš Kurilić. The Center leader is Prof. Stevan Pilipović, while Prof. Nataša Krejić is the coordinator of scientific activities.

A detailed presentation of the scientific activities will be given in the texts concerning the particular scientific groups – projects financed by the Ministry of Science and Technological Development, while this text is concerned with the activities of the Center that are part of the joint engagement of all members of the Center.

LEADING OF PROJECTS

NUMERICAL MATHEMATICS

- **Numerical methods for nonlinear mathematical models**
  Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010
  Project Leader: Prof. Nataša Krejić, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Dragoslav Herceg, Prof. Katarina Surla, Prof. Zorana Lužanin, Prof. Djordje Herceg, Prof. Helena Zarin, Assist. Prof. Sanja Rapajić.
  (The project will be presented in the frame of the activity of the corresponding research group.)

- **Modelling and Forecasting Stock Price Behaviour – Analysis of High Frequency Financial Data Dresdner Kleinwort Securities, London, 2006-2007**
  Project Leader: Prof. Nataša Krejić, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Marko Nedeljkov and Prof. Zorana Lužanin.
  In the frame of the project an analysis was performed of ultra-high frequency data and a model was worked out for predicting stock prices at the London Stock Exchange. The model is in use in the algorithmic stock trading. The project results are not publicly accessible.

ANALYSIS, PROBABILITY AND GEOMETRY

- **Methods of functional analysis, PDJ with singularities**
  Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010
  Project Leader: Prof. Stevan Pilipović, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Mirko Budinčević, Prof. Ljiljana Gajić, Prof. Marko Nedeljkov, Prof. Dušanka Perišić, Assoc. Prof. Danijela Rajter, Prof. Mirjana Stojanović, Prof. Arpad Takači, Prof. Djurdjica Takači, Assoc. Prof. Nenad Teofanov, Assist. Prof. Dora Seleši.
  External associates: Academician Bogoljub Stanković, Prof. Teodor Atanacković, Corresp. Member of the Serbian Academy of Sciences and Arts. (The project is presented in the frame of activities of the corresponding working group.)
- **The Pavle Savić Project, 2008-2009: Nonlinear theory of generalized functions and nonlinear partial differential equations**
  Project Leaders: Prof. Antoine Delcroix, Université des Antilles et de la Guyane (France) and Prof. Marko Nedeljkov, Faculty of Sciences, Novi Sad.
  The project is concerned with the study of hyperbolic equations with singularities and especially of conservation laws.
- **The Pavle Savić Project, 2004-2005: Methods of functional analysis in equations with singularities**
  Project Leaders: Prof. Jean Andre Marti, Université des Antilles et de la Guyane (France) and Prof. Stevan Pilipović, Faculty of Sciences, Novi Sad.
  The project objective was to study algebras of generalized functions, ultra-generalized functions, and generalized hyperfunctions. Within such structures, various classes of equations with singularities were considered.
- **DAAD Project in the framework of the Stability Pact for South East Europe Center of excellences for applications of mathematics: APPLICATIONS OF MATHEMATICS, 2002-2009**
  Project Leader: Prof. Stevan Pilipović, Faculty of Sciences, Novi Sad.
  In the frame of the project several intensive courses were organized as well as exchange of PhD students, Novi Sad being the center of the project activities.
- **UNESCO International Basic Science Programme 2005-2007: Pseudo-differential operators and microlocal analysis**
  Project Leader: Prof. Stevan Pilipović, Faculty of Sciences, Novi Sad.
  The studies carried out within the project dealt with Theory of pseudo-differential operators through the analysis of small waves with the applications in time-frequency analysis.
- **Mathematical Modeling 2007-2010; (C1Z20)**
  Project Leader: Prof. Arpad Takači, Faculty of Sciences, Novi Sad.
  The project's objective is to study methodological approaches to teaching mathematics with the applications in chemistry, physics, at the faculties and high and professional schools.

List of the universities and institutions with which the Center established cooperation:

- State University of Campinas, Campinas; SP, Brazil
- Technical University of Dresden, Germany
- Humboldt University, Berlin, Germany
- OCIAM Oxford, Great Britain
- Lappeenranta University of Technology, Finland
- Technical University of Eidenhoven, The Netherlands
- University of Milan, Italy
- University of Turin, Italy
- University of Cagliari, Italy
- Steklov Institute of Mathematics, Russian Academy of Sciences, Russia
- University of Vienna, Austria
- University Paris 7, France
- University of Guadeloupe, France
- Imperial College London, England
- University of Katowice, Poland
- Mathematical Institute of Bulgarian Acdemy, Bulgaria
- Seoul University, Korea
- Tokyo University, Japan
- Nagoya University, Japan
- Vaxjo University, Sweden.

List of scientific meetings whose organizers or co-organizers were members of the Center:

- Intensive course „Automatic differentiation of the optimization and singular problems", Novi Sad September 2009;
- Intensive course „Differential calculus, conservation laws and application in mechanics", Novi Sad, October 5-12, 2008;
- The 12th Serbian Congress of Mathematics, Novi Sad, August 2008;
- Mathematics and Mechanics, Symmetries in Mechanics, Novi Sad September 24-27, 2007;
- Intensive course „Fractional calculus with applications in mechanics", Novi Sad, September 16-24, 2007;
- PRIM 2006, Conference of applied mathematics, Kragujevac, September 25-27, 2006;
- Intensive course „Numerical optimization and application", Novi Sad, May 22-31, 2006;
- Pseudodifferential operators and microlocal analysis, UNESCO, Novi Sad, March 6-12, 2006;
- PRIM 2004, Conference of applied mathematics, Subotica;
- Intensive course „Multidimensional splines, small-wave analysis and conservation laws", Novi Sad, September 19-29, 2004;
- Conference „Mathematical analysis and applications", Niška Banja, October 2-6, 2002;
- PRIM 2002, Conference of applied mathematics, Herceg Novi.

FORCING, MODEL THEORY AND SET-THEORETICAL TOPOLOGY

- **Forcing, model theory and set-theoretical topology models and set theory**
  Ministry of Science and Technological Development of the Republic of Serbia, 2006-2010
  Project Leader: Prof. Miloš Kurilić; Member: Prof. Milan Grulović, Faculty of Sciences, Novi Sad.
- **The Pavle Savić Project , 2004-2005; Set Theory: ultraproducts and forcing**
  The project was financed by the Republic of Serbia and France.
  Project Leader: Prof. Miloš Kurilić, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Milan Grulović, Assist. Prof. Aleksandar Pavlović, Faculty of Sciences, Novi Sad.
  By this project commenced the cooperation with a group of mathematicians from France, among them being our outstanding mathematicians Profs. Stevo Todorčević (CNRS) and Boban Veličković (University Paris 7).

CONFERENCES, INTENSIVE COURSES

Intensive courses are intended for students of doctoral studies, while the lecturers are renowned professors from abroad, as well as the members of the Center.

The conferences are devoted to applied mathematics - PRIM meetings have already become traditional and gained reputation in the country and abroad. They cover all the areas of applied mathematics. The founder and organizer of these conferences is Prof. Dragoslav Herceg.

The conferences from Analysis with the application in mechanics and other areas of physics were organized by the Center members in cooperation with colleagues from some other universities. A great number of guests from abroad supported the organization of these conferences in Novi Sad and other centers in Serbia.

A special place occupies the conference GF 2004, Novi Sad, which was devoted to theory and applications of generalized functions. The GF conferences are traditional international conferences and the Novi Sad Center has an outstanding role in the organization of such conferences in other world centers, too.

The 12th Serbian Congress of Mathematics, the most important manifestation in the field of mathematics in our country, was organized in Novi Sad. Members of the Center had the leading role in the organization of the Congress, attended by a great number of participants from abroad.

SCIENTIFIC COMPUTING: APPLIED LINEAR ALGEBRA

The Center "Scientific Computing: Applied Linear Algebra" (SC:ALA) of the Department of Mathematics and Informatics of the Faculty of Sciences, University of Novi Sad, started officially to work in 2008. The goal of the Center is to unite, motivate and direct research activities in the area of applied linear algebra, which have previously been realized through several projects, the results of which have been better known and recognized at the international than at the national level. By its foundation, the SC:ALA has become practically the only research center in the area of applied algebra in Serbia. Thanks to close links with numerous institutions and research groups in the world, the Center has become known for its research in this area, both in the country and abroad. These investigations are becoming more and more recognizable with time and acquire a significant place in the frame of multidisciplinary projects from various branches of natural science and engineering. In this way the Center enables the links with potential users, making thus the results achieved more accessible to a wider scientific and technological community. By its dynamic organization of the research teams for particular problems to be solved, the SC:ALA also realizes its other great goal of including young people in research work, thus contributing to the strengthening of the research potential of the country. An invaluable contribution to this have certainly the regular thematic seminars and workshops, often attended by outstanding scientific personalities from the institutions and scientific associations with which the Center has established cooperation.

LEADING OF PROJECTS

- **Multilateral Research Cooperation Applied Linear Algebra**
  Project No.: 114-451-02010/2008; The Project was financed by the Provincial Secretariat for Science and Technological Development of AP Vojvodina.
  Project Leader: Prof. Ljiljana Cvetković, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Ljiljana Cvetković and Vladimir Kostić.
  The objective of the project was to deepen cooperation with researchers and research centers in Spain and Poland, exchange of researchers, participation in scientific conferences with joint contributions, joint publication of the results, as well as the introduction of young people into research work.
- **Multilateral Research Cooperation Numerical Linear Algebra**
  Project No.: 114-451-02211/2008; The project was co-financed by the Provincial Secretariat for Science and Technological Development of AP Vojvodina.
  Project Leader: Prof. Ljiljana Cvetković, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Ljiljana Cvetković and Vladimir Kostić.
  The aim of the project was to strengthen cooperation with researchers and research centers from Greece and USA, exchange of researchers, organization of joint workshops, as well as the introduction of young people into scientific research.

sc:ala

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International Cooperation

From the very foundation of the Center, its associates have been often invited to various international institutions from the USA, China, Russia, Spain and Poland. They have been invited as plenary lecturers at five international conferences (Prof. Ljiljana Cvetković to China, Spain, Russia and Hong Kong, and Vladimir Kostić to Poland).
International reputation is recognized through the fact that the Center leader, Prof. Ljiljana Cvetković, acted as guest-editor of special issues of international journals of highest category: *Numerical Algorithms, Linear Algebra and its Applications*, and *Numerical Linear Algebra with Applications*. Prof. Ljiljana Cvetković is one of the editors of the international journal *Central European Journal of Mathematics*.
Intensive international cooperation is realized with the following institutions:

- The Institute for Computational Mathematics, Kent State University, USA,
- Department of Mathematics and Informatics, Faculty of Mathematics and Natural Sciences, University of Wuppertal, Germany,
- Instituto de Matemática Multidisciplinar, Universidad Politécnica de Valencia, Spain,
- Facultad de Ciencias, Universidad de Zaragoza, Zaragoza, Spain,
- Faculty of Mathematics and Computer Science, Adam Mickiewicz University, Poznan, Poland,
- Institute of Mathematics of the Polish Academy of Sciences, Warsaw, Poland,

- Department of Mathematics, University of Ioannina, Ioannina, Greece,
- Department of Mathematics, Faculty of Civil Engineering, Czech Technical University, Prague, Czech Republic,
- Chinese Academy of Sciences, Beijing, China
- Fudan University, Shanghai, China,
- Rostov State University, Rostov-on-Don, Russia,
- GAMM Activity Group Applied and Numerical Linear Algebra.

ORGANIZATION OF INTERNATIONAL CONFERENCES

In the frame of international cooperation, a significant number of foreign scientists have visited Novi Sad. Besides, associates from the Center have been members of program committees of several international conferences. But the activity that made the Center recognizable in the world in a short time are just the conferences "Applied Linear Algebra", organized in honor of the outstanding scientists in the field of applied algebra. Some of them are:

- Richard S. Varga (Applied Linear Algebra Conference – in honor of Richard Varga, held on the Palic Lake in 2005; web: http://ala2005.ns.ac.yu);
- Ivo Marek (Applied Linear Algebra Conference – in honor of Ivo Marek, held in Novi Sad in 2008; web: www.im.ns.ac.yu/events/ala2008/);
- Hans Schneider (the conference will be held in Novi Sad in 2010).

- **Numerical Linear Algebra, Stochastics, and Statistics with Applications**
  Program of fundamental research of the Ministry of Science and Technological Development of the Republic of Serbia
  Project No.: 144025
  Project Leader: Prof. Ljiljana Cvetković, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Ljiljana Cvetković, Prof. Zoran Stojaković, Prof. Zagorka Lozanov-Crvenković, Assist. Prof. Miloš Stojaković, Vladimir Kostić.
  The project is presented within the activities of the corresponding group.
- **Tools of Linear and General Algebra in Computer Science**
  Project No.: 0708
  The project is co-financed by the Provincial Secretariat for Science and Scientific Development of AP Vojvodina
  Project Leader: Prof. Ljiljana Cvetković, Faculty of Sciences, Novi Sad.
  Researchers: Prof. Ljiljana Cvetković, Prof. Siniša Crvenković, Prof. Igor Dolinka, Assist. Prof. Miloš Stojaković, Vladimir Kostić, Nebojša Mudrinski.
  The project objective is to find new possibilities for the application of modern results in the area of linear and general algebra in computer science. Mathematical modeling in various branches of natural and social sciences is always faced with the necessity of using some of numerical or statistical procedures that will adequately describe the phenomenon and enable finding of answers to the questions posed. Implementation of the appropriate computer algorithms requires additional analysis and modification of the procedures. Studies in the frame of this project are focused on this part of the mathematical model preparation.

ANALYSIS SEMINAR (SINCE 1962)

Seminar Founder and Leader: Academician Bogoljub Stanković

Presently, the Seminar activities encompass two projects from Analysis and Topology, whose leaders are S. Pilipović, Corresp. Member of the Serbian Academy of Sciences and Arts and Prof. M. Kurilić.

TRADITION

The Seminar has a long tradition. It began to work in 1962 as a regular (weekly) seminar of the Chair of Mathematics at the Faculty of Philosophy, University of Novi Sad (with two teachers of mathematics) and Institute of Mathematics of the Serbian Academy of Sciences and Arts. Later, the Seminar has narrowed its scope to Mathematical Analysis, in order to presently become the seminar of two projects that are realized at the Department of Mathematics and Informatics of the Faculty of Sciences in Novi Sad. The long-standing activity of the Seminar has been at the same time the process of growing up of a great number of mathematicians that are presently recognized in the mathematical world.

ORGANIZATION

In the beginning, on the recommendation of a professor, a Seminar member could become somebody of the teaching staff of the Chair of Mathematics of the Faculty of Sciences as well as senior students majoring in mathematics. Such 'rejuvenation' of the Seminar has given very good results since the young at the beginning of their research career were directed toward modern problems and instructed in the methodology of doing professional and scientific work. Presently, a member of the Seminar may be any mathematician involved in teaching mathematics at any faculty of the University of Novi Sad, all those who work on the two mentioned projects, as well as selected senior students.

OBJECTIVE

The objective is to bring together and animate people to work jointly on modern problems of mathematics, especially those that are subjects of the two mentioned projects, to get acquainted with new results and methods in mathematics, and help younger mathematicians to get included into team work.

FORM OF THE WORK

The form of the work has undergone changes in the course of the Seminar's staff 'growing up' and broadening of the scope of problems considered. For example, a number of members get interested in a particular problem or a complex of problems, study the results already achieved and identifies some still open issues, and then work jointly on that given problem. Their results, be they partial or complete, are presented at the Seminar. In the course of the work there has appeared the need to choose an opponent to every presenter, as well as to practice discussion in English. The intention is to advance the quality of presentation of the results and prepare people for doing this at the international meetings and for visits to foreign institutions.

TOPICS

Generalized functions and their application in theory of differential and partial differential equations was the area in which the Seminar began its activity and which has dominated its further work. Afterwards, the attention has been focused on fixed-point theory in locally convex spaces and its application in probability spaces, asymptotic behavior of solutions of differential equations and optimization problems. Presently, the scope of the Seminar work is much wider.

INTERNATIONAL COOPERATION

Establishment of the links and cooperation with other institutions and individuals has enabled Seminar members to get acquainted with modern problems of mathematics and get involved in the work on them. First joint projects have been mainly arranged through the academies of sciences of USSR, Poland, Bulgaria; through universities in Hungary and individual mathematicians from the USA. Also, contracts have been signed for joint work on the projects financed from the Joint USA-Yugoslavia Fund (1985-88 and 1989-92). Nowadays, the cooperation is much wider. It encompasses the centers such as Faculty of Science of Vienna University, Faculty of Science of Turin University, University Paris 7, as well as a number of other universities in the world. One of activities is also the organization of joint meetings. The Institute of Polish Academy of Sciences in Katowice, headed by the Academicain J. Mikusiński, was the imitator of holding annual or biannual conferences on the results of studying the Field of J. Mikusiński Operators. This initiative was the subject of talks at the conference in Szczyrk (Poland) held in 1963. The Seminar was the organizer of the first such conference outside Poland, held in Srebrno, June 16-21, 1971. It was attended by mathematicians from Poland, USSR and Hungary (three persons from each country), Bulgaria (two) and one from Yugoslavia. Up to now, 14 such conferences have been held in various countries all over the world, but with a much wider scope of topics and a much larger number of participants. They are still devoted to Generalized Functions (GF) as well as other problems of functional analysis. The last three conferences that were organized by the Seminar members were held in Dubrovnik (GF 1987) and Novi Sad (GF 1996 and GF 2004).

ANALYSIS, GEOMETRY AND PROBABILITY

Members of the Research Group

Members of this Project are mainly professors and teaching assistants form the Department of Mathematics and Informatics, Faculty of Science in Novi Sad, but also researchers from the other scientific institutions from Novi Sad, Belgrade, Subotica and Kragujevac.

Members from the Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad:

- Dr Stevan Pilipović, full professor, Corresp. Member of the Serbian Academy of Sciences and Arts (SASA)
- Dr Marko Nedeljkov, full professor
- Dr Mirjana Stojanović, full professor
- Dr Arpad Takači, full professor
- Dr Djurdjica Takači, full professor
- Dr Mirko Budinčević, full professor
- Dr Dušanka Perišić, full professor
- Dr Ljiljana Gajić, full professor
- Dr Nevena Pušić, full professor
- Dr Nenad Teofanov, associate professor
- Dr Danijela Rajter-Ćirić, associate professor
- Dr Dora Seleši, assistant professor
- Jelena Aleksić, MS, teaching assistant
- Milica Žigić, junior assistant.

Project members from other institutions:

- Dr Bogoljub Stanković, full professor, Academician of SASA
- Dr Voja Marić, full professor, Academician of SASA
- Dr Hajnalka Peić, associate professor, Faculty of Civil Engineering, Subotica
- Dr Marko Kostić, assistant professor, Faculty of Technical Sciences Novi Sad
- Dr Milorad Mijatović, research associate, Business College
- Dr Sanja Konjik, assistant professor, Faculty of Agriculture, Novi Sad
- Dr Vesna Manojlović, assistant professor, Faculty of Organizational Science, Belgrade
- Dr Ljubica Oparnica, research associate, Institute of Mathematics of SASA, Belgrade

The Group for Analysis, Geometry and Probability is organized in the frame of the project of the Ministry of Science and Technological Development of the Republic of Serbia and Analysis Seminar. The Ministry project "Methods of functional analysis and partial differential equations with singularities" is headed by Prof. Stevan Pilipović, Corresp. Member of the Serbian Academy of Sciences and Arts. Scientific research in the frame of the project represents a continuation of the previous projects and subprojects financed by the Ministry, whose leaders were Prof. Stevan Pilipović and Academician Bogoljub Stanković.

The Group has a long and interesting history. A number of scientific workers who are not any more at the Department of Mathematics and Informatics of the Faculty of Sciences, or who have changed their research interests, participated in its foundation. Their contribution to the research work has been really significant, and it is not easy to write a text about the Group without mentioning their names and their merits. However, since this presentation is intended to cover only scientific research in the current period, we believe that the contribution and merits of our colleagues that are not mentioned here will be presented in detail in the appropriate publications devoted to the scientific work in mathematics at the Faculty of Sciences since its foundation.

The Project occupies one of the leading places among all the projects from mathematics and mechanics in Serbia.

This is one of the three projects included in the "Center of Excellence for Mathematical Study of Nonlinear Phenomena". The Analysis Seminar has been headed by the Academician Bogoljub Stanković since 1962.

RESEARCH AREAS

Studies within the Project encompass the following areas of mathematics with applications.

1. EQUATIONS WITH SINGULARITIES AND ALGEBRAS OF GENERALIZED FUNCTIONS – This area includes the analysis of various spaces and algebras of generalized functions and in the frame of these spaces study of equations of mathematical physics, local and microlocal analysis of solutions.
2. STOCHASTIC ANALYSIS – Study of stochastic processes, stochastic ordinary and partial differential equations.
3. CONSERVATION LAWS – Analyses cover the systems conservation laws through different forms of weak solutions, generalized waves based on modern theories of nonlinear analysis.
4. EVOLUTION SYSTEMS – The focus is on evolution equations via various classes of subgroup operators and development of theory of generalized functions, udltradistributions and hyperfunctions with values in Banach spaces.

5. TIME-FREQUENCY ANALYSIS – Theories of frames and small waves are applied to analyze generalized modulation spaces as well as various classes of pseudo-differential operators.
6. DIFFERENTIAL GEOMETRY – It is concerned with the analysis of manifolds through the classification of various types of manifolds and analysis of functions and generalized functions on manifolds.
7. APPLICATIONS IN MECHANICS – In various mechanical models, there appear derivatives of fractional order, and hence the motivation to study them.

RESULTS SINCE 2002

In the period from 2002 the Project participants have published more than 150 papers, delivered 11 plenary lectures, and presented more than 100 contributions at international conferences. Also, 13 MS and 7 PhD theses have been defended in the frame of the Project.

The MS theses that were supervised by the Project members obtained: Marko Kostić, Darko Mitrović, Ljubica Oparnica, Sanja Konjik, Radoslava Mirkov, Anita Vlahek, Dora Seleši (the Mileva Marić–Einstein Award for the best MS thesis from Mathematics and Informatics at the University of Novi Sad), Katarina Saneva, Dušan Rakić, Mirjana Vuletić, Jelena Aleksić, Vladimir Ćurić and Nebojša Dedović.

The PhD theses supervised by the Project members obtained: Marko Kostić, Katarina Saneva, Dora Seleši, Ljubica Oparnica, Sanja Konjik, Diana Dolićanin and Bratislav Iričanin.

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- Dr Vladimir Božin, associate researcher, Institute of Mathematics of SASA, Belgrade
- Suzana Simić, MS, teaching assistant, Faculty of Sciences, Kragujevac
- Dušan Rakić, MS, teaching assistant, Faculty of Technology, Novi Sad
- Vladimir Ćurić, MS, teaching assistant, Faculty of Technical Sciences, Novi Sad.

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PROJECTS

Apart from the projects of the Ministry of Science and Technological Development of the Republic of Serbia, the Group members have participated in the leading and realization of a number of foreign projects, which have been mentioned in the frame of the activities of the Center of Excellence.

- **DAAD-Project in the frame of the Stability Pact for the South-Eastern Europe, Center of Excellence, 2002-2009, Applications of Mathematics**
  Project Leader: Prof. Hener Gonska.
  Coordinator for the Faculty of Sciences, Novi Sad: Prof. Stevan Pilipović.
- **The Pavle Savić Project 2004-2005: Methods of functional analysis in the equations with singularities.**
  Project Leaders: Prof. Jean Andre Marti, Universite des Antilles et de la Guyane (France) and Prof. Stevan Pilipović, Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad (Serbia).
- **UNESCO International Basic Science Programme 2005-2006: Pseudo-differential operators and microlocal analysis**
  Project Leader: Prof. Stevan Pilipović, Department of Mathematics and Informatics, Faculty of Science, Novi Sad

- **The Pavle Savić Project 2008-2009: Nonlinear theory of generalized functions and nonlinear partial differential equations**
  Project Leaders: Prof. Antoine Delcroix, Universite des Antilles et de la Guyane (France) and Prof. Marko

Conferences and Intensive Courses

The Group members have participated in numerous conferences and other scientific meetings, such as schools and intensive courses. Of special importance were the conferences organized or co-organized by the Group members, namely: GF2004, Novi Sad (Serbia); GF2007, Bendlevo (Poland); GF2009, Vienna (Austria); the 12th Serbian Congress of Mathematics 2008, Novi Sad (Serbia); Conferences on Time-Frequency Analysis, Novi Sad, 2003 and 2005. Besides, four intensive courses (summer schools) were organized for PhD students and young researchers from Serbia and countries from the South-Eastern Europe (Romania, Bulgaria, FYR Macedonia, Montenegro, Bosnia and Herzegovina, Moldova).

Additional Activities

Professor Stevan Pilipović has been visiting professor at the following universities: University Paris 7, University of Vienna, University in Innsbruck, University of Turin, and University of Cagliari.
In the frame of scientific cooperation the Group members have been hosts of a great number of collaborators and guests from abroad, especially from Austria, Italy, France, Sweden and Great Britain. Members of the Group have acted as reviewers of numerous papers in world journals as well as for *Math Rev and ZBL for Mathematics*. Special attention is devoted to young associates, postgraduate and PhD students that are supervised by the members of the Group.

10. Nedeljkov, M., Delta and singular delta locus for one-dimensional systems of conservation laws. *Math. Methods Appl. Sci.* 27 (2004), No. 8, 931—955.
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NUMERICAL MATHEMATICS

Research of the Group encompasses numerical procedures for solving mathematical problems arising from nonlinear models in economy, finances, agriculture, chemistry, ecology, and technology, as well numerical solving of parameter-dependent ordinary and partial differential equations.

The main research direction is concerned with the construction and analysis of iterative procedures for solving various problems of nonlinear optimization – smooth and semi-smooth systems of nonlinear equations, nonlinear and complementary problems, and problems of stochastic programming. Studies deal with the analysis of the problem and formulation of iterative algorithms for their solving, as well as the analysis of convergence in computer testing of the obtained results on relevant examples arising from the mathematical models in economy, finances, agriculture, and technology. Depending on the origin of the model, mathematical problems have a special structure, so that the research emphasis is put on perceiving special properties of the systems, which facilitates construction of iterative procedures and improves their efficiency. Special attention is paid to numerical results, because they are also influenced by the theory of parameter estimation, which entails a significant application of the apparatus of mathematical statistics.

The other research direction is related to the application and analysis of selected numerical methods for improving accuracy of approximate solutions of singularly perturbed problems. The main characteristic of these problems is the abrupt change of the solution behavior over certain regions when the perturbation parameter converges to a boundary value. The development of numerical methods for solving such singularly perturbed problems (SPPs) is of great practical interest. The SPPs represent mathematical models of numerous phenomena in nature such as the process of environmental pollution, processes of heat transfer with a high Peclet number, processes of fluid flow with a high Reynolds number, as well as the processes of chemical kinetics. Besides, the SPPs serve also as models to study new mathematical algorithms.

RESULTS

From 2000 to the present, members of the Group have published numerous papers in mathematical journals of international significance, delivered plenary lectures, and presented their results at different domestic and international conferences and meetings. Besides, in the course of the work on the project, 14 MS and 4 PhD theses were defended by young members, supervised by some of the members working on the project.

Members of the Working Group

Members from the Department of Mathematics and Informatics, Faculty of Science, Novi Sad:

- Dr Dragoslav Herceg, full professor
- Dr Katarina Surla, full professor
- Dr Nataša Krejić, full professor
- Dr Zorana Lužanin, full professor
- Dr Djordje Herceg, associate professor
- Dr Helena Zarin, associate professor
- Dr Sanja Rapajić, assistant professor
- Goran Radojev, junior teaching assistant

Group members from the Faculty of Technical Science, Novi Sad:

- Dr Zorica Uzelac, full professor
- Dr Ljiljana Teofanov, assistant professor

To the Group also belong three young researchers: Sandra Buhmiler, MS, Andrea Rožnjik, MS, and Mirjana Brdar, five holders of scholarships of the Ministry of Science and Technological Development of the Republic of Serbia, and two PhD students from abroad (FYR Macedonia and Great Britain).

Contact Person

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Organization of the Group

The Group for Numerical Analysis has worked continually since 1980. In the period from its foundation to 2006 the Group was headed by Prof. Dragoslav Herceg, and since2006 to the present by Prof. Nataša Krejić. In the course of its work the Group has realized a number of scientific projects, and presently is engaged on the project "Numerical Methods for Solving Nonlinear Models", financed by the Ministry of Science and Technological Development of the Republic of Serbia. This project is one of the three projects included in the "Center of Excellence for Mathematical Research of Nonlinear Phenomena".

Work with Young Researchers

MS Theses: Jelena Nedić, Miroljub Miloradović, Ivana Radeka, Branko Prentović, Sandra Buhmiler, Ivana Manić, Vojislav Timarac, Nataša Teodorović, Andrea Rožnjak, Zoltan Pap, Tibor Lukić, Tanja Nedić, Dragan Kovačević i Ivana Sladoje.

PhD Theses : Helena Zarin, Sanja Rapajić, Miroljub Miloradović i Ljiljana Teofanov

From 1980 to the present 29 MS theses and 13 PhD theses were defended, and five scholarship holders of the Ministry of Science and Technological Development of the Republic of Serbia and two foreign students work on ther PhD theses.

Conferences

Members of the Group for Numerical Analysis have participated with contributions in numerous international mathematical conferences and meetings in the country and abroad. In the period from 2000 to the present they organized Applied Mathematics seminars PRIM 2000, PRIM 2002, PRIM 2004, PRIM 2006, and particpated as co-organizers of the 12th Serbian Mathematics Congress, held in 2008. In this period, two intensive course were held for young mathematical researchers and PhD students.

Awards

Helena Zarin won the Mileva Marić-Einstein Award for her PhD thesis in 2003, Nataša Krejić and Zorana Lužanin won awards of the Ministry of Science and Technological Development in 2004.

Other Activities

In addition to the projects financed by the Ministry the Group members participate in leading and organization of projects mentioned in the section concerning the Center of Excellence. Besides, they are included in the work of domestic and international numeric journals as editors and reviewers. Thus, Prof. Dragoslav Herceg is Editor-in-Chief of the journal Novi Sad Journal of Mathematics. Special attention is paid to the international cooperation and advanced training of young researchers, PhD students.

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GENERAL AND APPLIED ALGEBRA, THEORETICAL COMPUTER SCIENCE AND MATHEMATICAL LOGIC

RESEARCH AREAS

The Group engaged on the project "Algebra Structures and Information Processing Methods", works in the following areas:

- General Algebra
- Universal Algebra
- Associative Structures
- Applied Algebra
- Theory of Networks and Ordered Structures
- Algebraic Logic, Mathematical Logic
- Constructive Algebra
- Methodology of Mathematics Teaching
- Theoretical Computer Science
- Algebraic Theory of Fuzzy Sets

The Group members act as editors of mathematical journals in the country and abroad, reviewers of articles for domestic and international journals. Several associates are members of the American Mathematical Society.

The scientific output of this group makes the articles that have been published or are currently in the process of publishing in the leading world journals from the field of algebra. Six researchers from the Group are scientists of Category A according to the evaluation of the Ministry of Science and Technological Development of the Republic of Serbia. The project participants have also been visiting professors at several foreign universities. Also, several PhD degrees have been earned abroad.

Of the newest achievements it may be pointed out that Dr Zoran Djindjić Award for the best young researchers in the year 2006 obtained Dr Igor Dolinka.

The Group members have published papers from the areas of applied algebra in medicine, biology, physics, meteorology, teaching methodology, and pedagogy.

The mentioned researchers are also authors of several scientific monographs published in Serbian and English languages.

SELECTED REFERENCES

1. Crvenković, S., Tasić, Decidability of semigroup identities in soluble groups, *J. Group Theory* 5, (2002), 107-118.

Members of the Working Group

- Dr Zoran Stojaković, full professor
- Dr Siniša Crvenković, full professor
- Dr Branimir Šešelja, full professor
- Dr Gradimir Vojvodić, full professor
- Dr Vojislav Petrović, full professor
- Dr Rozalija Madaras-Silađi, full professor
- Dr Andreja Tepavčević, full professor
- Dr Olga Bodroža-Pantić, full professor
- Dr Igor Dolinka, full professor
- Dr Ivica Bošnjak, assistant professor
- Dr Petar Marković, assistant professor
- Dr Petar Djapić, teaching assistant
- Maja Pech, MS, teaching assistant
- Nebojša Mudrinski, MS, teaching assistant

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Organization of the Group

The Group consists of the researchers gathered around the project "Algebraic Structures and Information Processing Methods", No.: 144011, Ministry of Science and Technological Development of the Republic of Serbia, as well as around the project "Network Methods and Applications" of the Provincial Secretariat for Science and Technological Development of AP Vojvodina. The same researchers are also members of the Chair of Applied Algebra, and Chair of Mathematical Logic and Discrete Mathematics of the Faculty of Sciences in Novi Sad. In the group formation participated also a number of researchers who are not any more members of the Department, but they also have given very important contribution to the overall results.

Cooperation

The Group collaborates with the universities in Szeged and Budapest (Hungary), St. Andrew (Scotland), Nashville (USA), Fredericton (Canada), Milan and Florence (Italy), Prague (Czech Republic), Krakow (Poland), Banska Bistrica (Slovakia, bilateral project), Dresden (Germany, DAAD bilateral project), Oviedo (Spain) and Lausanne (Switzerland).

Algebraic School

Nowadays, many of the alumni of the Novi Sad algebraic school are professors in the USA, Canada, Great Britain and West Balkan countries.

Equipment

The Group has at its disposal the newest computer equipment, projectors, and teaching means procured thanks to the money obtained for the projects.

2. Crvenković, S., Dolinka, I., Tasić, V., A locally finite variety of rings with undecidable equational theory, *Quarterly Journal of Mathematics (Oxford)*, 57 (2006), 297-307.
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MATHEMATICAL MODELING OF NONLINEARITY, UNCERTAINTY AND DECISION MAKING

RESEARCH AREAS

REAL OPERATIONS

The major part of the Group's research has been devoted to real operations, a wide class of aggregation functions (Monograph No. 4) and particularly to their important subclasses: triangular norms, triangular co-norms, uninorms and copulas (Monograph No. 1), with numerous important applications in theory of decision making, theory of probabilistic metric spaces (Monograph No. 2), partial differential equations.

NONADDITIVE MEASURES

An important research area is the theory of general and nonadditive measures, where, in the already classical monograph of the academician E. Pap (Null-Additive Set Functions, Kluwer, 1995), the previous results were for the first time united in a unique theory that served as a basis for further research, both within the Group and much wider. Theory of integrals, starting from the Choquet to Sugeno integral, occupies a special place in the Group research and various applications. In the frame of pseudo-analysis, which provides a unique apparatus for molding problems with nonlinearities and uncertainties, and corresponds to the needs of optimization, it was possible to model complex preference problems, cumulative prospect theory (CPT), hybrid probability-potentiality theory of usefulness as an expansion of the Neumann-Mongerstern theory. The monograph No. 3, written in cooperation of 43 world renowned mathematicians, contains the major part of the main results of both the classical measure theory and recently developed areas.

MODELING OF UNCERTAINTIES

In the frame of probabilistic metric spaces, the use of the investigated properties of triangular norms, and first of all enumerable expansion of the triangular norms, yielded the generalization of fixed-point theorem, which presently develops in various directions. Using the theory of triangular norms it was possible to obtain axiomatization of the Lukasiewiecz logic, as well as the product-based logic. Using the fuzzy approach a model was obtained for treatment of databases with diverse types of data.

NONLINEAR EQUATIONS:

Significant attention has been paid to various applications of pseudoanalysis, first of all of nonlinear equations (ordinary and partial differential equations, difference equations, optimization equations), and especially to theory of nonlinear partial differential equations, where one should single out the results related to the Burgers, Hamilton-Jacobi, Perona-Malik, Prandtl and Monge-Ampere equations.

Members of the Research Group

- Academician Olga Hadžić
- Academician Endre Pap
- Dr Ivana Štajner Papuga, associate professor
- Dr Milan Milosavljević, full professor, Faculty of Electrical Engineering, Belgrade
- Dr Aleksandar Jovanović, full professor, Faculty of Mathematics, Belgrade
- Dr Nebojša Ralević, full professor, Faculty of Technical Sciences, Novi Sad
- Dr Tatjana Žikić Došenović, assistant professor, Faculty of Technology, Novi Sad
- Dr Aleksandar Takači, assistant professor, Faculty of Technology, Novi Sad
- Dr Marta Takač, assistant professor, Teacher's Faculty, Subotica
- Dr Tatjana Grbić, assistant professor, Faculty of Technical Science, Novi Sad
- Biljana Mihailović, MS, Faculty of Technical Sciences, Novi Sad
- Mirjana Štrboja, MS, teaching assistant
- Ljubo Nedović, MS, Faculty of Technical Sciences, Novi Sad
- Dragan Jočić, MS, College of Commerce
- Branka Nikolić, MS, Teacher's Faculty, Novi Sad

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Organization of the Group

The Group has been already working successfully for twenty years, and presently is organized around the project of the Ministry of Science and Technological Development of the Republic of Serbia entitled "Mathematical Modeling of Nonlinearities, Uncertainties and Decision Making (Project Leader: Academician Endre Pap).

PROJECTS

Apart from the projects financed by the Ministry of Science and Technological Development of the Republic of Serbia, the Group members have also participated in the following projects:

- **CEEPUS SK-42, 1999-2004; FUZZY CONTROL**
  Project Leaders: Prof. Radko Mesiar, University of Bratislava and Academician Endre Pap, Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad
- **Mathematical models for decision making under uncertainty conditions and their application**
  Provincial Secretariat for Science and Technological Development of AP Vojvodina
  Project Leader: Acad. Endre Pap, VANU and Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad.
- **The Pavle Savić Project 2006-2007: AGGREGATION FUNCTIONS FOR DECISION MAKING (Fonctions d'aggregationpour la decision common)**
  Project Leaders: Prof. Michel Grabisch, University 1, Sorbonne, Paris and Acad. Endre Pap, Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad
- **Bilateral project Slovakia-Serbia, 2009-2009: MODELING USING COMPUTER INTELLIGENCE UNDER UNCERTAIN CONDITIONS IN INFORMATION SYSTEMS**
  Project Leaders: Prof. Radko Mesiar, University of Bratislava and Acad. Endre Pap, Department of Mathematics and Informatics, Faculty of Sciences, Novi Sad

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2. O. Hadžić, E. Pap, Fixed Point Theory in Probabilistic Metric Spaces, Mathematics and Its Applications 536, Kluwer Academic Publishers, Dordrecht/Boston/London, 2001, 278 pp., ISBN 1-4020-0129-0.
3. E. Pap (Urednik), Handbook of Measure Theory, Volume I, II, Elsevier, North-Holland, 2002, 1636 pp., ISBN: 0-444-50263-7.
4. M. Grabisch, J. L. Marichal, R. Mesiar, E. Pap, Aggregation Functions, Cambridge University Press, 2009, 500pp.

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12. E. Pap, M. Takacs, Two dimensional copulas as important binary aggregation operators, *Journal of Advanced Computational Intelligence and Intelligent Informatics* 10 No.4 (2006), 522-526.
13. E. Pap, Generalized real analysis and its applications, *Int. J. Approximative Reasoning* 47 (2008), 368-386.
14. P. de Lucia, E. Pap, Cafiero approach to Dieudonne's type theorems, *J. Math. Anal. Appl.* 337 (2008), 1151-1157.
15. R. Mesiar, E. Pap, Aggregation of infinite sequences, *Information Sciences* 178(18) (2008), 3557-3564.

CONFERENCES

The Group's invaluable contribution makes the organization of the already traditional SISY Conference, International Symposium on Intelligent Systems and Informatics in Subotica, held every year starting from 2003 in cooperation with the Vojvodina Academy of Sciences and Arts, Budapest Polytechnic University, Technical College of Subotica, Department of Mathematics and Informatics of the University of Novi Sad, Ministry of Science and Technological Development of the Republic of Serbia, Provincial Secretariat for Science and Technological Development of AP Vojvodina, Hungarian Fuzzy Association, IEEE Neural Networks Chapters (Hungery), IEEE Joint Chapter of IES and RAS (Hungary) and town of Subotica. The principal chairman from Serbia is Academician Endre Pap, and from Hungary Prof. Janos Fodor, PhD, Vice-Rector of the Budapest Polytechnic University.

The main aim of this traditional symposium is to bring together researchers of various profiles (engineers, mathematicians, informaticians, economists, physicians), first of all from Hungary and Serbia; also attended with contributions by researchers from Italy, France, Slovakia, Austria, Belgium, Luxembourg, Romania, Slovenia, Canada, Iran, Israel, Portugal, Australia, USA, Pakistan. The symposium enables further widening of cooperation in the actual area of intelligent systems: decision-making theory, fuzzy systems, fuzzy and neuro-fuzzy control, knowledge-based systems, expert systems, intelligent robots, man-robot interaction, intelligent mechanotronics: CAD/CAM/CAE systems, and applications in the industry, economy, education, medicine, traffic.

Academician Endre Pap has been a member of a number of program committees of international conferences, among them it should be singled out the following traditional conferences (attended also by the other Group members): International Linz Seminar on Fuzzy Sets, Linz (Austria) (annual); International conference on fuzzy set theory and its applications, FSTA, Liptovsky Jan (Slovakia) (biannual); International Max-plus workshop (biannual); International Symposium on Imprecise Probabilities and their Applications ISIPTA (biannual); International Summer School on Aggregation Operators and their applications AGOP (biannual).

Awards and Signs of Recognition

In September of 2005, Academician Endre Pap was elected Professor of Honors at the Budapest Polytechnic University. Besides, he received the October Prize of Novi Sad for the year 2003.

Additional Activities

Since 2004, Academician Endre Pap has actively participated in the work of the Vojvodina Academy of Sciences and Arts (VANU), and even more actively since he has been elected President of VANU in 2008. Academician Pap is also a member of the European Academy of Science (Brussels) and a member of editorial boards of international journals *Fuzzy Sets and Systems* (North-Holland) – world leading journal for intelligent information systems, and Editor for the area of nonstandard measures; *Tatra Mountains Mathematical Publications* (Slovakia), *Yugoslav Journal of Operations Research*; *Novi Sad Journal of Mathematics*; *Paneconomicus*; *Archive of Oncology*; *Acta Polytechnica Hungarica*. In 2006, Academician Pap was elected a member of the Commission for accreditation and verification of the quality of high education institutions in the National Council for High Education of the Republic of Serbia; he is President of the Expert Council for Natural Sciences and Mathematics of the University of Novi Sad, and a member of the Senate of the University of Novi Sad since 2007.

The members of the Group have acted as referees of a number of papers for renowned international journals, as well as for *Mathematical Reviews* and *ZBL for Mathematics*. In the last seven years, Academician Endre Pap have been visiting professor at the Johann Kepler University Linz, La Sapienzain Roma, Sorbonne, Paris, and Federico II University, Naples.

NUMERICAL LINEAR ALGENBRA, STOCHASTICS AND STATISTICS WITH APPLICATIONS

RESEARCH AREA

In their research, members of the Project are concerned with the following areas:

MATRIX THEORY

Activities in this area are oriented in the direction of the possibility of the applications of linear algebra, and in that sense the goal has been achieved since the results on the localization of characteristic roots have recently been used and cited in papers of foreign authors working in the area of control theory. The research is concerned with the problem of generalized eigenvalues and improvement of the results on the convergence of iterative procedures for solving systems of large-dimension linear equations adapted to work on parallel computers.

THEORETICAL COMPUTER SCIENCE AND DISCRETE STRUCTURES

Studies in this area are focused on combinatorial network algorithms, analysis of algorithmic problems related to graph games and solving the game problem on random graphs. The achieved results provide new interesting insights into the algorithms on permutation sets and algorithms for approximate sorting. Numerous results have also been achieved concerning positional games on graphs, in which winning structures are selected from the class of conventional graph structures.

STOCHASTICS AND STATISTICS

The objective is to treat various forms of indeterminacy using theory of stochastic processes, conditional expectation and fuzzy sets. Through following the unavoidability of statistical models in modern experimental scientific disciplines the work is oriented to constructing new autoagressive and minification processes for modeling time series.

RESULTS

Since 2005 the Group members have published 24 papers in international mathematical journals of highest category (7 papers of category M21(R51a), 10 papers of category M22(R51b) and 7 papers of category M23(R52)), presented 34 contributions at international conferences, and obtained two awards.

Members of the Research Group

- Dr Ljiljana Cvetković, full professor
- Dr Zoran Stojaković, full professor
- Dr Zagorka Lozanov-Crvenković, full professor
- Dr Miloš Stojaković, assistant professor
- Vladimir Kostić, junior teaching assistant

Project associates from other faculties and universities:

- Dr Mila Stojaković, Faculty of Technical Sciences, Novi Sad
- Dr Biljana Popović, Faculty of Sciences, Niš
- Dr Miroslav Ristić, Faculty of Sciences, Niš
- Aleksandar Nastić, MS, Faculty of sciences, Niš
- Maja Nedović, Faculty of technical Sciences, Novi Sad.

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Organization of the Group

The Group consists of the associates working on the project No. 144025 "Numerical Linear Algebra, Stochastics and Statistics with Applications", started in 2006, and financed by the Ministry of Science and Technological Development of the Republic of Serbia.

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12. Stojaković, M., Stojaković, Z., Series of fuzzy sets, *Fuzzy Sets and Systems* (2009), in print.

CONFERENCES

The Group members have presented 34 contributions at the international mathematical conferences in the country and abroad (USA, Germany, Luxembourg, Greece, Spain, Poland, Czech Republic, China, Hong Kong, Russia, Brazil, Switzerland, Israel).

AWARDS

- Dr Miloš Stojaković is the recipient of the Dr Zoran Djindjić Award for the best young scientist and researcher in AP Vojvodina in 2008.
- Vladimir Kostić obtained First Prize for the best presentation among young participants of the MAT TRIAD Conference in Poland in 2007.

Other Activities

Since 2005 the Group members have been more than ten times guests in various international institutions in the USA, China, Russia, Spain, Poland, Switzerland, and as invited plenary lecturers at six international conferences (Vladimir Kostić in Poland, Prof. Ljiljana Cvetković in China, Spain, Russia, Hong Kong and one international conference held in our country).

Engagement of students and the Ministry scholarship holders in research

From the beginning of the work on the project "Numerical Linear Algebra, Stochastics and Statistics with Applications" seven holders of the scholarship of the Ministry of Science and Technological Development of the Republic of Serbia have been included in the work. Each of them has participated in the international conferences or summer schools. In some cases, undergraduate students too have been included in the research and were enabled to participate in the international conferences.

Engagements in Journals

A sign of international recognition is also the fact that Prof. Ljiljana Cvetković has acted as guest editor of special issues of the journals of highest category: *Numerical Algorithms* (M23), *Linear Algebra and its Applications* (M22) and *Numerical Linear Algebra with Applications* (M21), as well as one of the editors of the international journal *Central European Journal of Mathematics*.

FORCING, MODEL THEORY AND SET-THEORETIC TOPOLOGY

RESEARCH AREAS

SET THEORY

Forcing method produces new models of set theory – mathematical universes. The research subject is the existence of various types of new sets and preservation of old structures (maximal almost-disjunctive families, ultrafilters, splitting families, and the like) in the new models. Such structures are classified according to their stability with respect to various forcings and establish the appropriate hierarchy. The ZFC characterizations of these phenomena are sought and expressed in the languages of topology and theory of Boolean algebras. Further, games of infinite length on Boolean algebras are also investigated. These games describe various properties of Boolean algebras: algebraic, forcing and set-theoretic, as well as the properties associated with measure theory.

SET-THEORETIC TOPOLOGY

Studies are performed of topological structures induced by orderings: linearly ordered spaces and their generalizations, GO-spaces, Boolean spaces, trees, as well as topologies on Boolean algebras. Topological methods are used to study algebraic, forcing and set-theoretic properties of Boolean algebras, as well as the properties associated with measure theory (cardinal invariants, distributivity, homogeneity, measurability, etc.).

MODEL THEORY

Studies are carried out in the area of model-theoretic forcing, as well as the reduced and ultraproducts from the standpoint of model theory and set theory.

RESULTS

Since its foundation in 2002, the Group members have published 18 articles in international mathematical journals and had 18 contributions to international conferences, and obtained three awards. The work on the Project has also resulted in three MS and two PhD theses.

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2. M. S. Kurilić, B. Šobot, Power-collapsing games, *J. Symbolic Logic*, 73,4 (2008) 1433-1457.

Members of the Research Group

- Dr Milan Grulović, full professor
- Dr Miloš Kurilić, full professor
- Dr Aleksandar Pavlović, teaching assistant
- Boris Šobot, MS, teaching assistant

Contact Person

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Organization of the Group

The Group was founded in 2002. In the period from 2006 onward the Group members have worked on the project "Forcing, Model Theory and Set-Theoretic Topology II", financed by the Ministry of Science and Technological Development of the Republic of Serbia, and which is a continuation of the project "Forcing, Model Theory and Set-Theoretic Topology", financed by the same ministry in the period 2002-2005. Project Leader: Prof. Miloš Kurilić.

This project is one of the three projects included in the Center of Excellence for Mathematical Study of Nonlinear Phenomena, financed by the Ministry of Science and Technological Development of the Republic of Serbia.

In the period 2004-2005, the Group members participated in the bilateral Serbia-France cooperation named after Pavle Savić, working on the joint project "Set Theory: Ultraproducs and Forcing". The project leaders were Prof. Miloš Kurilić from the Faculty of Sciences and Prof. Boban Veličković from the French side. The French institutions involved were: Universite Paris 7 and Centre national de la recherche scientifique (CNRS).

3. M. Z. Grulović, A few remarks on n-infinite forcing companions, *Publ. Inst. Math.* (Beograd) (N.S.) 82 (96) (2007) 51-57.
4. M. S. Kurilić, A. Pavlović, A posteriori convergence in complete Boolean algebras with the sequential topology, *Ann. Pure Appl. Logic* 148 (2007) 49-62.
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MS AND PHD THESES

- PhD theses: A. Pavlović and B. Šobot.
- MS theses: A. Pavlović, B. Šobot and N. Perić.

CONFERENCES

The Group members presented 18 contributions at the international mathematical conferences in the country and abroad (Greece, Italy, Austria, Spain, Slovakia, Germany).

In the frame of international cooperation the Group has organized sojourns of a number of foreign scientists in Novi Sad. Altogether, there were 15 such visits: Stevo Todorčević, CNRS (Paris, France) 9 times; Boban Veličković from the University Paris 7 (Paris, France) 5 times, and Justus Diller, from the Westfalischen Wilhelms Universitat in Munster (Munster, Germany) one visit.

Awards

Aleksandar Pavlović and Boris Šobot obtained the Mileva Marić-Einstein Award for the best MS thesis from mathematics and informatics at the University of Novi Sad. Miloš Kurilić obtained award of the Ministry of Science and Technological Development of the Republic of Serbia for two papers from the 30% of the SCI-list in 2004.

Other Activities

Apart from research, the Group's activity encompasses also training of young members of the Group, international cooperation and activities in scientific journals.

Participation of young members of the Group in workshops and summer schools

Based on the Project's financial resources it was possible to finance eight sojourns of young researchers abroad to attend workshops and summer schools held in Czech Republic, Germany and Israel.

Engagement in journals

Some Project members are engaged in the work of mathematical journals. Thus, Prof. Miloš Kurilić is a member of the Editorial Board of the journal *Publications de l' Institut Mathematique*, and Dr Aleksandar Pavlović is the secretary to the *Novi Sad Journal of Mathematics*.

INFORMATICS

RESEARCH AREAS

Modeling of the systems for information processing using XML schemas and WSDL represents the basis for the development of a new approach to the design and implementation of distributed information systems. Verification of the proposed approach has been demonstrated on concrete examples of electronic business. Special attention in the development of information systems is paid to databases. In this research field the possibilities are considered of developing an intelligent system for database management that supports elements of the fuzzy set theory and XML standard.

Modeling of business flow and systems for managing business flow, as well as their applications in real environments, represents a further important part of the research. Technology of mobile agents, formalization and design of graphical environments in the area of business flow management give a new quality to the modeling and application in various domains. On the other hand, intelligent agents that include various techniques of artificial intelligence (with a special emphasis on case-based inference) represent the basis for formalization and development of different systems in the following areas: Web mining, distance learning, and business management.

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Members of the Research Group

All the Group members are employed at the Department of Mathematics and Informatics.

- Dr Zoran Budimac, full professor
- Dr Mirjana Ivanović, full professor
- Dr Djura Paunić, full professor
- Dr Miloš Racković, full professor
- Dr Dušan Surla, full professor
- Dr Dragan Mašulović, associate professor
- Dr Dragoslav Pešović, assistant professor
- Dr Srdjan Škrbić, teaching assistant
- Danijela Boberić, MS, research associate
- Bojana Dimić, MS, research associate
- Ljubomir Jerinić, MS, teaching assistant
- Živana Komlenov, MS, teaching assistant
- Vladimir Kurbalija, MS, teaching assistant
- Zoran Putnik, MS, teaching assistant
- Miloš Radovanović, MS, teaching assistant
- Danijela Tešendić, MS, research associate
- Dragana Todorić-Vukašin, MS, teaching assistant
- Jovana Vidaković, MS, teaching assistant
- Dragan Dukić, research associate
- Dejan Mitrović, research associate
- Doni Pracner, research associate
- Ivan Pribela, junior teaching assistant
- Gordana Rakić, junior teaching assistant
- Saša Tošić, junior teaching assistant

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PROJECTS

- **Learning support system with application of data-mining and data security**
  Project Leaders: Prof. Mirjana Ivanović (Novi Sad) and Dr Tatjana Welzer-Družovec (Maribor), 2008-2009, Ministry of Science of Serbia and Slovenia.
- **Software agents in Web services and in the semantic Web**
  Project leaders: Prof. Zoran Budimac (Novi Sad) and Dr S. Ambroszkiewicz (Warsaw), 2005-2007, SASA and Polish Academy of Sciences.
- **Web-based course-supporting and e-learning system for courses in informatics**
  Project Leader: Prof. Zoran Budimac, 2006-2007, WUS, Austria.
- **Using artificial intelligence in text and web mining**
  Project Leaders: Prof. Mirjana Ivanović (Novi Sad) and Dr Dunja Mladinić (Ljubljana), 2005-2006, Ministry of Science of Serbia and Slovenia.
- **Development of (intelligent) techniques based on software**
  Project Leader: Prof. Zoran Budimac, 2002-2005, Ministry of Science of the Republic of Serbia.
- **Abstract methods and applications in computer science**
  Project Leader: Prof. Dragan Mašulović, 2006-2010, Ministry of Science and Technological Development of the Republic of Serbia.
- **Joint Master Studies in Software Engineering**
  Project Leader: Prof. Mirjana Ivanović, 2008-2009, CEI University Network. Other: Institute of Informatics, Faculty of Science, Skopje, FYR Macedonia.
- **International Cooperation in Computer Science**
  Coordinator for the University of Novi Sad: Prof. Zoran Budimac; Project Coordinator: Prof. Zoltan Horvath, Budapest, 2006-2009, CEEPUS II.
- **Software Engineering: Computer Science Education and Research Cooperation**
  Coordinator for the University of Novi Sad: Prof. Zoran Budimac; Project Coordinator: Prof. Klaus Bothe, Berlin, 2001 – 2009, Stability Pact for South-eastern Europe sponsored by Germany.
- **Joint MS Curriculum in Software Engineering**
  Project Leader: Prof. Klaus Bothe, TEMPUS CD-JEP-18035-2003, 2004-2008, supported by EUROPEAN COMMISSION - TEMPUS, Consortium members: Humboldt University Berlin, Germany, University of Deusto, Bilbao, Spain; De Montfort University, Leicester, UK.

Organization of the Group

The Group is engaged on the project ***"Abstract Models and Application in Computer Sciences"***, financed by the Ministry of Science and Technological Development of the Republic of Serbia. The Group is headed by Prof. Dragan Mašulović and its activities encompass a wide spectrum of topics in the field of computer science and its practical application. Thanking to the engagement of the Group members ten undergraduate teaching courses in Informatics have been introduced or reformed, so that they are now compatible to the corresponding courses in other countries. Master studies concerning software engineering (being also the same in another two institutions in Europe) came also about as a consequence of the engagement of the Group members on the improvement of teaching activities. In the frame of these activities the Department of Mathematics and Informatics obtained computer equipment worth about EUR 40,000. The Group members participated actively in the process of Faculty accreditation at all three study levels.

Results

MS theses
- Miloš Radovanović
- Vladimir Kurbalija
- Danijela Boberić
- Bojana Dimić
- Miodrag Mirković
- Kosa Nenadić
- Jelena Radjenović
- Gordana Rudić
- Vera Stojadinović
- Dragana Šumić
- Predrag Tekić
- Danijela Tešendić
- Živana Komlenov
- Aleksandra Klašnja
- Boban Vesin
- Zoran Putnik

PhD theses
- Dragoslav Pešović
- Srđan Škrbić

INNOVATION CENTER FOR ELECTRONIC LIBRARIES AND ARCHIVES

Members of the Research Group

- Dr Dušan Surla, full professor
- Gordana Rudić, MS, librarian
- Danijela Tešendić, MS, research associate
- Danijela Boberić, MS, research associate
- Bojana Dimić, MS, research associate
- Dr Zora Konjović, full professor, Faculty of Technical Sciences, Novi Sad
- Dr Branko Milosavljević, full professor, Faculty of Technical Sciences, Novi Sad

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Activities

Activities of the Innovation Center have had its impact on the improvement of teaching in the field of information-communication technologies and systems. The results of the project and solutions to the problems that have been encountered in its realization have been used in the teaching process at the Faculty of Sciences and Faculty of Technical Sciences in Novi Sad in the areas of information systems, databases, electronic business systems, etc. Besides, the optional course ***Digital Archives***, directly inspired by and relied upon the Project results, introduced in the master study from the area of applied computer sciences and informatics at the Faculty of Technical Sciences, is very popular with students.

The Council of the Faculty of Sciences in Novi Sad at its 2nd session held on January 18, 2007 passed the decision on founding the Innovation Center for Electronic Libraries and Archives at the Department of Mathematics and Informatics of the Faculty of Sciences Novi Sad. At the same session Prof. Dušan Surla was appointed the Head of the Innovation Center.

The main activity of the Innovation Center is the development of the library software system BISIS. The system has been in the process of development since 1993, in the frame of the projects financed by the Ministry of Science of the Republic of Serbia and Executive Council of the Autonomous Province of Vojvodina. Up to now, four versions of the BISIS system have been developed.

In 2007 appeared a new (fourth) BISIS version, in which user's interface was significantly improved for both catalogization and loaning library documents. Also, a number of reports on bibliographic records (Acquisition, Statistic, Fund state, Inventory book) as well as on the use of library material (Statistical report on library users, Report on reading library materials) were added. The BISIS works on publicly accessible operating systems (various Linux versions) and databases for which no additional license payment is needed. Also, it works on commercially available operating systems (Windows, UNIX, etc.), as well as on commercially available databases.

From 2005 on, continual work has been performed on the realization of the project of the Library Network of Parent Libraries of Vojvodina, financed by the Executive Council of AP Vojvodina, and under support of the corresponding provincial secretariats. This network comprises five parent libraries from AP Vojvodina and three specialized libraries, and the overall number from the whole Republic of Serbia is 36 libraries (8 faculty libraries, 1 university library, 24 public libraries and 4 specialized libraries). All the mentioned libraries from AP Vojvodina have adopted Ver. 4 of the BISIS in 2008. On the suggestion of the Secretariat for Education of AP Vojvodina to introduce software for electronic operation of libraries, a positive reply gave 17 high-education institutions for 21 libraries and three secondary schools. In 2009, these 24 libraries will also start to use Ver. 4 of the BISIS system.

Based on the program of the development of the BISIS system, two-year TEMPUS project of the European Union was obtained in 2002. The results of the development of the BISIS system have been published in domestic and foreign scientific journals and presented at a number of conferences, both in the country and abroad. Thus, for example, the monograph Distributed Library Information System BISIS published in 2004 contains 165 references. During 2008, seven papers concerning the development of Ver. 4 of the BISIS system were published/accepted in the international journals. Besides, the work on the project itself or directly related to it resulted in 16 MS theses, 2 PhD theses, as well as numerous diploma works.

LABORATORY FOR THE DEVELOPMENT OF INFORMATION SYSTEMS

The Laboratory for the Development of Information Systems at the Department of Mathematics and Informatics of the Faculty of Sciences Novi Sad is a laboratory that offers services and expertise in the pertaining areas.

The work of the Laboratory is focused on particular projects that include providing services and expertise, design of information systems, integration of information systems, maintenance and services related to server systems, support and help in the domain of information technologies, support and help in purchasing computer equipment and software, offering services to the interested users from the area of the Laboratory activities, organization of courses for training and knowledge refreshment in the domain of information technologies, research concerning the development of information technologies and mentioned systems, organization of thematic meetings, seminars, as well as workshops and conferences.

In the last seven years, the Laboratory members have designed and upgraded part of the Information system of the Faculty of Sciences, to support work of students' services and other students' and teachers' transactions. This information system has attracted attention of the other legal entities and physical persons, so that it was implemented at the Faculty of Sports and Physical Education and is planned to be implemented at the other faculties, too. Besides this segment of information system, the Laboratory is engaged on the realization of the complete information system of the Faculty of Sciences.

Members of the Research Group

- Dr Miloš Racković, full professor
- Dr Dušanka Perišić, full professor
- Dr Dragoslav Pešović, assistant professor
- Dr Srdjan Škrbić, teaching assistant
- Biljana Pupovac, MS, professional associate – informatician
- Ivan Pribela, junior teaching assistant
- Žarko Bodroški, professional associate – administrator
- Sava Mikalački, junior researcher
- Dragan Dukić, junior researcher
- Branislav Ivošev, professional associate – administrator

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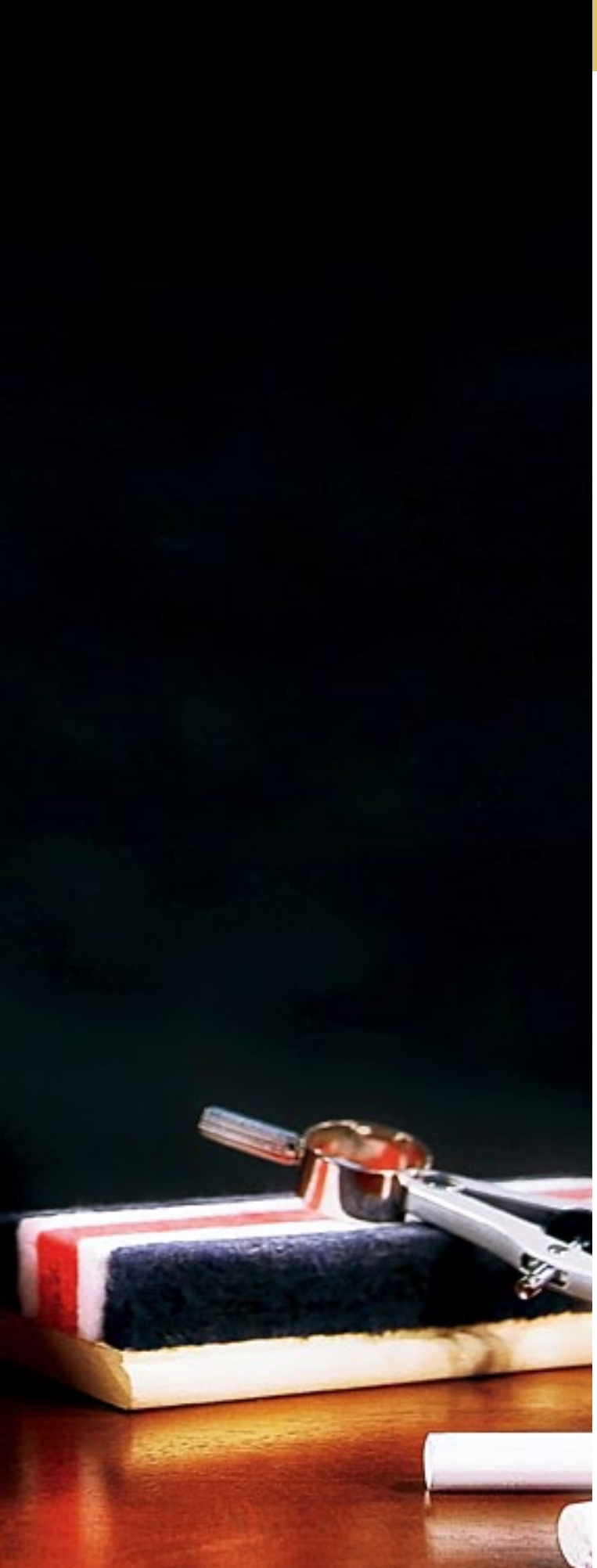

Teaching **Methodologies**

The accreditation of the Faculty of Sciences as a scientific research organization encompasses also teaching methodologies (area of social sciences).

The realization of the program of doctoral studies of Methodology of Teaching Natural Sciences (biology, chemistry, physics, geography) and Mathematics and Informatics, in which, in accordance with the requirements of modern education, are integrated natural sciences, psychology, pedagogy, didactics and methodology of profession teaching, the students acquire a high-level knowledge that allows them to understand current problems of teaching natural sciences, mathematics and informatics and capability of their solving with the aim of advancement and development of education and increasing its quality and efficiency.

METHODOLOGY OF TEACHING BIOLOGY AND ECOLOGY

Members of the Group

- Dr Tomka Miljanović, associate professor
- Vera Drakulić, MS, teaching assistant

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SELECTED REFERENCES

Miljanović, T. (2001): Efficiency of active biology teaching compared to traditional teaching, *Nastava i vaspitanje*, 3-4: 347-355. (in Serbian).

Miljanović, T. (2002): Student's attitude to active biology teaching, *Nastava i vaspitanje*, 3: 155-165. (in Serbian).

Grujičić, M., Miljanović, T. (2005): Influence of modern didactic media on the efficiency of biology teaching, *Nastava i vaspitanje*, 4-5, 327-337. (in Serbian).

Milivojević, V., Miljanović, T. (2006): Active learning of ecological contents in biology teaching in primary school, *Nastava i vaspitanje*, 4, 414-422. (in Serbian).

Niklanović, M., Miljanović, T. (2006): Efficiency of active learning of ecological contents in primary school, *Pedagogija*, 4, 506-511. (in Serbian).

Drakulić, V., Miljanović, T. (2007): Efficiency of laboratory-experiment method in the realization of biology teaching in high school, *Pedagogija*, 4, 627-632. (in Serbian).

Miljanović, T., Janošev A. (2008): Achievements of secondary-school students in biology competition at the republican level, *Pedagogija*, 1, 107-114. (in Serbian).

Terzić, J, Miljanović, T. (2009): Efficiency of the application of multimedia in high-school biology teaching, *Nastava i vaspitanje*, 1, 5-14. (in Serbian).

The Group organizes seminars for biology teachers working in primary and secondary schools. These seminars were accredited by the Department for Education Advancement from Belgrade. The Group members are also engaged in the preparation of didactic materials for teaching biology in primary and secondary schools.

Biology Teaching Methodology is a science about the organization, techniques and technologies and knowledge evaluation in biological education. Its importance is recognized through the responses to contemporary problems of biology teaching, by studying:

- Aims and tasks of education in the contents of biology teaching;
- Selection, sequence, and didactic-methodological shaping of biology teaching;
- Influence of psychological factors on acquiring knowledge about biological processes and phenomena;
- Learner's attitude to different biological contents;
- Process of biology learning (efficiency of the different teaching forms and methods, methodological procedures and techniques);
- Quality of biology curricula, textbooks, handbooks, and other means for students and teachers;
- Degree of interrelationship between knowledge, abstractness, and working and technical activities in biology teaching;
- Significance and teaching effects achieved in the out-of-class activities through biological and ecological study groups and additional biology teaching.

PARTICIPATION IN PROJECTS

- **TEMPUS Joint European Institution Building Project: Improvement of Teaching Quality in South East Europe (N° IB JEP 16081 2001-2004)**

  Project Coordinator: Dr Dieter Poschardt, Friedrich-Alexander-Universität, Erlangen-Nürnberg Erziehungswissenschaftliche Fakultät from Germany.

  Partners on the Project: Erziehungswissenschaftliche Fakultät, Erlangen-Nürnberg (Germany), and universities from Albania, Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, Serbia (Faculty of Sciences Novi Sad), and some universities from Austria and France as partner countries.

  The aim of the project was to improve the quality of teaching natural sciences in the South-Eastern Europe.

  The results were two seminars for training related to the innovative models of biology teaching for teachers of biology from the Republic of Serbia.

Exercise in the higher plants determination at the seminar Modern Teaching of Biology, Novi Sad, January 2008.

- **TEMPUS - Science Teacher Education Revision and Upgrading (STERU), JEPCD40053-2005-2009**
  Project Coordinator: Prof. Srećko Trifunović, Faculty of Sciences, Kragujevac.
  Partners on the Project: Faculty of Sciences, Kragujevac, Faculty of Sciences Niš and Faculty of Sciences Novi Sad; Faculty of Biology, Faculty of Chemistry, Faculty of Mathematics, Faculty of Physics from Belgrade; Faculty of Mathematics and Science, University of Jyväskylä (Finland), and Debreceni Egyetem, Természettudományi Kar (Hungary).
  The aim of the project was to harmonize the curricula of undergraduate and graduate academic studies – master studies in education majors (BS in biology - master – teacher of biology, geography, chemistry, physics, mathematics and informatics).
  The project's outcome is the accredited education programs for the mentioned majoring profiles at the Faculty of Sciences Novi Sad (already completed) and at the other faculties, partners in the project (currently in progress).
- **TEMPUS, Higher Education Reform of Biological Sciences (HERBS), JEP 400942005 (2006-2009)**
  Project Coordinator: Prof. Gordana Cvijić, Faculty of Biology, Belgrade.
  Partners on the Project: Faculty of Sciences in Kragujevac, Faculty of Sciences in Niš and Faculty of Sciences in Novi Sad; Faculty of Biology in Belgrade; Faculty of Sciences in Nice (France), Madrid (Spain) and Turin (Italy).
  The aim of the project was to harmonize the teaching programs of undergraduate academic study (biologist, ecologist) and graduate academic studies – master of biological and ecological majoring profile (BS in biology - master, BS in biology - master – BS molecular biology and BS in ecology - master).

TEXTBOOKS AND MONOGRAPHS

Žderić, M., Miljanović, T. (2001): Methodology of Biology Teaching, Institute of Biology, Faculty of Sciences, Novi Sad. (in Serbian)

Miljanović, T., Žderić, M. (2001): Didactic-methodological examples form Biology Teaching Methodology, Institute of Biology, Faculty of Sciences, Novi Sad. (in Serbian)

Stevanović, V., Lakušić, D., Topisirović, Lj., Petrov, B., Karan T., Radović, I., Ćetković, A., Vasić, V., Jovanović, S., Puzović, S. (2001): Biodiversity and new millennium, Serbian Ecological Society and Department of Protection of Nature in Serbia, Belgrade. (in Serbian)

Miljanović, T. (2004): Active Learning of Biology, Faculty of Sciences, Novi Sad. (in Serbian)

Grujičić, M., Miljanović, T. Žderić, M. (2004): Methodology of Biology Teaching, Department of Textbooks and Teaching Means, Srpsko Sarajevo. (in Serbian)

Budić, S., Gajić, O., Segedinac, M., Miljanović T., Španović. S. (2008): Didactic-methodological aspects of student's teaching practice in the partner faculty-school relations. Faculty of Philosophy Novi Sad. (in Serbian)

ACTIVITIES

- **Realization of the seminars for biology teachers working in primary and secondary schools that were accredited by the Department of Advancement of Education, Belgrade**

  In the 2006-2009 period, the following seminars were realized:

  1. Modern biology teaching in primary and secondary schools
     - Novi Sad, June 25-27, 2007 (59 participants);
     - Novi Sad, January 28-30, 2008 (48 participants);
     - Vršac, March 21-23, 2008 (16 participant);
     - Zrenjanin, November 7-9, 2008 (25 participants);

- Novi Sad, January 15-17, 2009 (19 participants).

2. Realization of ecological contents in primary and secondary schools:
- Novi Sad, July 02-04,. 2008 (15 participants).

The author and coordinator of the program of professional training of biology teachers is Prof. Tomka Miljanović. The seminars are realized by Prof. Tomka Miljanović and Vera Drakulić, MS.
The seminars were also accredited for the school year 2008/2009 and they will be held periodically according to the interests of biology teachers in primary and secondary schools.

- **Preparation of didactic materials for biology teaching in primary and secondary schools.**
  Authors: Prof. Tomka Miljanović, Miroslav Sič, BS, biology teacher – master and Vera Drakulić, MS.
  1. Miljanović, T., Sič, M., Drakulić, V.: Biology: OHP foils for primary school. Botany, Novi Sad, Veris studio, 2007. 60 p.
  2. Miljanović, T., Sič, M., Drakulić, V.: Biology: OHP foils for primary school. Zoology, Novi Sad, Veris studio, 2007. 60 p.
  3. Miljanović, T., Sič, M., Drakulić, V.: Biology: OHP foils for primary school. Ecology, Novi Sad, Veris studio, 2007. 70 p.
  4. Miljanović, T., Sič, M., Drakulić, V.: Biology: OHP foils for primary school. Anthropology, Novi Sad, Veris studio, 2007. 60 p.
  5. Miljanović, T., Drakulić, V.: Biology: Collection of questions for preparation of entry exams, Novi Sad, Studio Veris, 2008. 178 p.

Creative workshop at the seminar Modern Teaching of Biology, Zrenjanin, November 2008.

- **Strategy of the Development of the Education System in Transition Conditions**
  Ministry of Science and Technological Development of the Republic of Serbia; 2001-2005.
  Project Leader: Prof. Emil Kamenov, Faculty of Philosophy, Novi Sad.
  Partners on the Project: Faculty of Philosophy and Faculty of Science, Novi Sad and Teacher's Faculty, Sombor.
  The aim of the project was to contribute to the development of a strategy for creating of relatively original (adapted to our circumstances and needs, but still compatible with the systems of other, developed countries) system of education based on the results of sciences and scientific disciplines that are mainly concerned with education.
- **Didactic-methodological Aspects of Student's Practical Work in Partner Relations Faculty-School**
  Ministry of Science and Technological Development of the Republic of Serbia, 2007.
  Project Leader: Dr Spomenka Budić, Faculty of Philosophy, Novi Sad
  Partners on the Project: Faculty of Philosophy and Faculty of Sciences in Novi Sad and Teacher's Faculty in Sombor.
  The aim of the project was to propose a model of student's teaching practice with a solid conceptual basis that would encompass in full undergraduate studies of various pedagogical/teaching majoring profiles and their different forms (teaching practice, realization and evaluation of teaching lessons, etc.).
- **European Dimensions of Application of the Education System in Serbia**
  Ministry of Science and Technological Development of the Republic of Serbia; Project No.: 149009; 2006-2010
  Project Leader: Prof. Olivera Gajić, Faculty of Philosophy, Novi Sad.
  Partners on the Project: Faculty of Philosophy and Faculty of Sciences in Novi Sad and Teacher's Faculty in Sombor.
  The objective of the project is to get acquainted with the European education space (collecting relevant data, European normative solutions and practical foreign experience; theoretical analysis; detailed planning of further research steps, etc.), to compare the state in our country with the European experience and form strategies for the changes of the educational system in the Republic of Serbia.

METHODOLOGY OF PHYSICS TEACHING

PARTICIPATION IN PROJECTS

- **Tempus - Improvement of Teaching Quality in South East Europe № IB JEP 16081; 2001-2005.**
  Project Coordinator: Dr Dieter Poschardt, Director for International Relations, Erziehungswissenschaftliche Fakultät, Der Universität Erlangen-Nürnberg, Nürnberg, Germany. Participants on the Project: teachers from the faculties of natural sciences from the Western Balkans; from Serbia teachers from the Faculty of Sciences Novi Sad; Project Coordinator for Serbia: Gera Iboja, MS, Faculty of Philosophy in Novi Sad; Participants from the Department of Physics of the Faculty of Sciences, Novi Sad: Prof. Dušanka Obadović and Assist. Prof. Maja Stojanović (Garić).

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1. Gordana Hajduković Jandrić, Dušanka Ž. Obadović, Teaching Introductory Physics by Problem-Solving Method, *Pedagoska stvarnost* 5-6 (2007) pp. 46-50. (in Serbian)
2. M. G. Nagl, D. Ž. Obadović: Scientific Method in Teaching Physics in Languages and Social Sciences Department of High Schools, *Pedagoska stvarnost*, 7-8 (2008), pp. 707-715. (in Serbian)
3. D. Ž. Obadović, M. D. Segedinac and M. M. Stojanović, 'Hands on' Experiments in Integrated Approach in Teaching Physics and Chemistry, AIP Conference Proceedings 2007, Istanbul, Vol. 899, pp. 507-508.
4. S. Stanković, M. Vesković, O. Klisurić, V. Spasić: Medical Physics Education at the University of Novi Sad — Serbia", AIP Conference Proceedings 2007, Vol. 899, 2007, 515-516.
5. D. Ž. Obadović, M. Pavkov-Hrvojević And M. Stojanović, Scientific Method in Teaching Physics in Elementary And Secondary Schools, Fourth South-East European Workshop for 'Hands on' primary science education, Belgrade, Serbia, November 27-28, 2008, p. 23.
6. D. Ž. Obadović, M. Pavkov and M. Garić; Implementation of 'Hands on' Experiments in Teaching Physics, Proc. of Conference of Physicists of Serbia and Montenegro, Petrovac, Section 1, 2004, pp. 15-21. (in Serbian)
7. M. Bošnjak, D. Ž. Obadović, Fourth South-East European Workshop for 'Hands on' primary science education, Belgrade, Serbia, November 27-28, 2008"p. 24.
8. Gordana Hajduković Jandrić, and Dušanka Ž. Obadović, Enhancement of the Efficiency of Acquiring Knowledge of Physics Contents by Problem Solving Method, 9th International Symposium Interdisciplinary Regional Research, "ISIRR 2007", June 21– 22, 2007, Novi Sad p. 67.
9. D. Ž. Obadović, M. Garić, A. Vicko and A. Djurendić, 'Hands on' experiments in school architecture' International Workshop – Physics education and school architecture, Belgrade, 16 – 17 December, 2005.
10. Marija Bošnjak, Dušanka Ž. Obadović: Analysis of the subject 'Hands in dough - relevating the world' in teaching practice in the area of Western Bačka, *Pedagogija*, 1(2009), pp. 145-157.

Members of the Group

- Dr Dušanka Obadović, full professor
- Dr Maja Stojanović, assistant professor
- Dr Dušan Lazar, associate professor
- Dr Slobodanka Stanković, full professor
- Dr Olivera Klisurić, assistant professor

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ACCREDITED PROGRAMS OF PROFESSIONAL TRAINING OF THE EMPLOYED IN EDUCATION

Coordinator:
Prof. Dušanka Obadović:

- Thematic approach to teaching physics and chemistry in compulsory primary and general secondary education, №: 250/2003;
- Republic seminar on physics teaching, №: 42/2003;
- Thematic approach to teaching physics and chemistry in compulsory primary and general secondary education, №: 148/2007;
- Republic seminar on physics teaching, №: 149/2007;
- Teachers' seminar on teaching natural sciences, №: 118/20073;
- Thematic approach to teaching physics and chemistry in compulsory primary and general secondary education, №: 205/2008.
- Republic seminar on physics teaching, №: 206/2008;
- Teachers' seminar on teaching natural sciences, №: 70/2008.

Coordinator:
Prof. Slobodanka Stanković

- Physics in medical education, 159/2007;
- Physics in medical education, 204/2008/2009.

METHODOLOGY OF GEOGRAPHY TEACHING

Members of the Group

- Dr Jovan Romelić, full professor
- Dr Andjelija Ivkov-Džigurski, assistant professor
- Ljubica Ivanović, MS, teaching assistant

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Results

- three PhD theses
- twelve MS theses
- four specialist works
- one master work, and
- eighteen diploma works

The Group organizes seminars for geography teachers working in primary and secondary schools. These seminars are accredited by the Department of Advancement of Education, Belgrade. Also, the Group is engaged in designing didactic materials for geography teaching in the mentioned schools.

The subject of interest is the appropriateness of the application of didactic principles in geography education. This ensures a functional link with didactics, whose task is to study general laws and categories in educational activities.

Methodology of geography teaching is a science about the organization, techniques and technologies and evaluation of knowledge in geographical education. Its tasks come out from the degree of the development of geographical science and requirements imposed by the given social reality. These are main tasks of geography teaching. Further, the Methodology is concerned with the nature of the geography science, that is its bridging character; it endeavors to discover, establish and improve the relations to the other related school subjects. Therefore, the Methodology should find out the ways by which geographic and similar knowledges are presented in the form of functional integrational, interrelated system of knowledge, yielding thus the elimination of shortcomings of the excessive splitting of various teaching contents that anyway infer from each other.

The task of Methodology of geography teaching, that is of didactics, is the problem of selecting contents from the domain of geographical education, whose presentation should lead to optimal realization of teaching tasks.

The importance of this subject stems from providing answers to the problems of modern geography teaching by studying:

- Objectives and tasks of educational contents in geography teaching and its improvement
- Selection, sequence and didactic-methodological shaping of geography teaching, preparation and planning of teaching contents
- Systematization of notions and knowledge in the form of facts, principles, laws, theories, etc.
- Selection of the contents in accordance with psycho-physical capacities of schoolchildren and their logical distribution in accordance with age
- Pupil's relation to the different geographical contents
- Process of geography learning (efficiency of the application of various teaching forms and methodical procedures and techniques)
- Mode of defining the didactic material for a class
- Quality of geography curricula, textbooks, handbooks and other literature for pupils and teachers
- Significance of teaching effects realized through out-of-class activities such as geography study group, additional geography teaching, etc.
- Specificity of using teaching objects and the means in geographical education
- Objectivization of the evaluation of teaching work
- Development of the correlation principles of geography teaching with other teaching activities.

Solving work tasks at the seminar "GIS, multimedia and internet in the function of advanced teachers' training 1", Novi Sad, December 2007.

As additional activities of the Group members, but which are closely related to the Group research interests, it is possible to mention the following:

- Participation of Assist. Prof. Andjelija Ivkov-Džigurski in two conferences organized by the Ministry of Education and Sports, aimed at reforming education in the Republic of Serbia: „From a Vision to Concrete Steps" and „First Steps and the Forthcoming Challenges" September 05-07, 2002 and International conference - OSI Education Conference 2005: „Education and Open Society: A Critical Look at New Perspectives and Demands", held in Budapest.
- During 2006, Assist. Prof. Andjelija Ivkov-Džigurski acted as an expert consultant for editing and authoring the text „Serbia and Montenegro" of the Great Geographic Encyclopedia (The Kingfisher), of the Zmaj d.o.o. publisher from Novi Sad.
- Participation of Ljubica Ivanović, MS, in the conference „Professional development of the employed in education in the Republic of Serbia", Sremski Karlovci, November 2008, organized by the Department of Advancement of Education, Belgrade.
- In 2008, Assist. Prof. Andjelija Ivkov-Džigurski was the reviewer of the textbook, workbook and a handbook for geography teachers in grade six of primary school, published by „KLETT" D.O.O. from Belgrade, as well as the teaching source „Geographic Encyclopedia" – complete collection of OHP foils „Svet" (World) by Školska knjiga from Novi Sad in cooperation with TTE – Visual Transparencies to Educate BV.
- Reviewing (Prof. Jovan Romelić) of the book „Preparations of geography teachers for grade five of primary school", Zavod za udžbenike, Belgrade, 2008.
- Reviewing (Prof. Jovan Romelić) of the book „Preparation of geography teachers for grade five of primary school", Zavod za udžbenike, Belgrade, 2009.
- Profs. Jovan Romelić and Andjelija Ivkov-Džigurski were the members of the Commission for accreditation and quality evaluation of the Ministry of Education and Sports of the Republic of Serbia, reviewers for accreditation of higher education institutions and study programs.

ACTIVITIES

- **Accredited programs of professional training of education workers**
  Coordinator: Assist. Prof. Andjelija Ivkov-Džigurski
  Realization of the seminars for geography teachers in primary and secondary schools accredited by the Department of Advancement of Education, Belgrade.

Seminars:

1. GIS, multimedia and internet in the function of teachers' advanced training
   - Novi Sad, December 12-14, 2003 (19 participants)
   - Novi Sad, January 16-18, 2004 (17 participants)
   - Bajina Bašta, February 16-19, 2006 (29 participants)
   - Novi Sad, March 10-12, 2006 (19 participants)
   - Novi Sad, June 09-11, 2006 (10 participants)

2. Education of geography teachers for better application of active teaching methods
   - Novi Sad, December 19-21, 2003 (24 participants)
   - Novi Sad, January 16-18, 2004 (20 participants)
   - Novi Sad, January 23-25, 2004 (22 participants)

3. GIS, multimedia and Internet in the function of teachers' advanced training 1, 2007/2008:
   - Novi Sad, December 07-09, 2007 (21 participants)
   - Novi Sad, January 15-17, 2007 (25 participants)
   - Novi Sad, January 17-19, 2008 (19 participants)

4. GIS, multimedia and internet in the function of teachers' advanced training 2, 2007/2008
   - Novi Sad, February 08-10, 2008 (14 participants)
   - Novi Sad, February 15-17, 2008 (20 participants)

5. Interactive teaching – modern geographical education. Seminar was accredited for 2009/2010.

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METHODOLOGY OF CHEMISTRY TEACHING

Members of the Group

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Cooperation

- Faculty of Philosophy in Novi Sad, Chair of Pedagogy
- Faculty of Chemistry, Belgrade
- Teacher's Faculty, Sombor
- Department of Advancement of Education, Belgrade
- Ministry of Education of the Republic of Serbia
- Department of Professional Development of Education Workers, Belgrade
- Petnica Research Station

The Chair for Chemical Education and Methodology of Chemistry Teaching of the Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, Novi Sad realizes its scientific research in the following areas:

- Initial education and professional development of chemistry teachers;
- Modernization and reforms of the environmental education in chemistry teaching;
- Introduction of electronic teaching and distant education into teaching processes at all levels, as well as designing of electronic teaching materials adapted to our conditions;
- Training of chemistry teachers for the introduction of 'green-chemistry' contents in teaching.

In the previous years the Group has organized seminars for teachers of primary and secondary schools, at which they got acquainted with modern concepts of chemistry teaching, development of chemical notions, as well as with the use of digital technical means to visualize chemical notions. The notion of the structure of initial education of teachers is acutely and directly related to the definition of teacher's competence. In the frame of project the trends were analyzed in the organization of the initial education of teachers of particular subjects. Also, studies were made of teacher's education models in the European and other systems in the world, which were recognized as effective solutions in the comparative international studies. In the period from 1975 to 2009 significant changes occurred in the initial education of chemistry teachers, through essential changes in the structure, especially in the methodological-didactic block, in which the proportion of the teacher's time was increased significantly. The attitudes of primary school chemistry teachers were analyzed in light of the needs and possibilities of advancing professional training. Also, studies were made of the possibility of finding and applying a suitable model to activate students in learning general and inorganic chemistry in a higher professional model of individual choice and design of chemical experiments, which appeared to be a very effective way that may significantly influence the students' success in learning chemistry.

In the education of students of the majors *BS in Chemistry or BS –Chemistry Teacher and BS-Teacher of Chemistry and Biology (master)* several new subjects have been introduced: Modern Teaching Technologies in Chemical Education, Electronic Learning and Distance Learning, and Teaching Green Chemistry. Some electronic teaching materials for certain chemistry topics for the application in primary and secondary schools have been created and made accessible on the web page of the Chair of Chemical Education and Methodology of Chemistry Teaching. The application of information communication technologies (ICT) in education is one of the priorities dictated by the need of incorporating into modern trends and process of European integration. In the frame of this project studies have been made of the state of e-education in our country and of projects by which the concept of electronic and distance learning are to be introduced at the university level in Serbia. Further, the notions of e-education and distance education in modern education practice were de-

fined along with a historical survey of different types and applications. Also, the notion of e-classroom was introduced and defined along with the discussion of all the advantages and shortcomings of this computer-supported education, encountered by the educators in our educational environment. Some erroneous notions that designers of e-classroom are faced with in the process of its implementation were explained. In the area of e-learning the researchers studied various roles of the interactions in the process of knowledge transfer from the very beginnings of distance education.

Different roles and types of interactions have been discussed in the light of designing model of e-education with the emphasis on its role and significance. The attitudes of teachers in primary and secondary schools in Novi Sad and its surroundings were analyzed in respect of school equipment level, teacher's training and their readiness to use ICT in teaching natural and social sciences. The polling carried out in a large number of primary schools showed great differences in the degree of ICT implementation, but also a great readiness of teachers to accept electronic teaching materials designed in the Serbian language in accordance with the curriculum. The characteristics and possibilities of electronic teaching materials have been subjected to study and compared with classical printed materials. The members of the Chair designed electronic teaching materials for some chemistry areas for the application in primary and secondary schools. Part of these materials have been distributed as a pilot-project to chemistry teachers and put on the web page of the Chair.

The realization of the theme *"Modernization of the views and attitudes of teachers and school inspectors in the domain of environment-oriented education in the Republic of Serbia and AP Vojvodina"* has proceeded, as planned, in two stages. The first stage was concerned with the study of environment education themes that modernize teaching of natural sciences in a popular way but also present high scientific achievements. In the frame of studying modern methodologies of environmental education the method of team learning was implemented. In the second research stage the emphasis was put on the contribution of natural and social sciences to environmental teaching, that is on the multidisciplinarity and interdisciplinarity of this education. Of scientific topics that modernize environmental education the study encompassed Eco-archeology, Environmental management, and Modern spectroscopic methods in the environmental study. The investigations have also encompassed the contributions of known scientists who, directly or indirectly, influenced the development of environmental studies. The focus was on the multidisciplinarity and interdisciplinarity of the subject, with a reference to the contemporary environmental problems and modern environmental teaching.

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PARTICIPATION IN PROJECTS

- **TEMPUS Joint European Project SCIENCE TEACHER EDUCATION REVISION AND UPGRADING (CD_JEP-40053-2005)**
  Project Duration: 2005-2008
  Project Leader: Prof. Srećko Trifunović, Faculty of Sciences, Kragujevac.
  This was a project in which participated faculties of sciences of all universities in Serbia and it encompassed the activities on the introduction of common bases for the education of teachers of natural sciences, computer sciences and mathematics at all faculties in Serbia in accordance with the Bologna process.
- **European dimensions of the changes in the education system of Serbia (149009)**
  Ministry of Science and Technological Development of the Republic of Serbia
  Project Duration: 2005-2010
  Project Leader: Prof. Olivera Gajić, Faculty of Philosophy, Novi Sad.
  The project objective was to define an all-embracing concept of the strategic frame of education development relying on best national traditions on the one hand and European achievements on the other, to attain full harmonization of the education system on the European space.
- **Chemical education and history of science and education in Serbia (149028)**
  Ministry of Science and Technological Development of the Republic of Serbia; 2005-2010
  Project Leader: Prof. Snežana Bojović, Faculty of Chemistry, Belgrade.
  The project is concerned with the study of history of science and introduction of chemistry and other natural sciences into higher education in Serbia in 19th, 20th, and 21st century.

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METHODOLOGY OF MATHEMATICS TEACHING

In the last ten years or so, Methodology of Mathematics Teaching at the Department of Mathematics and Informatics has been developing intensively in both scientific and professional respect. The professors are especially active in undergraduate and postgraduate studies, which can be seen in a large number of diploma works, specialist works, several MS theses and PhD theses from the area of the methodology of mathematics teaching.

ACTIVITIES

At the Department of Mathematics and Informatics, international conferences devoted to mathematics teaching are organized regularly. Presently, preparations are made for **PRIM** (May 25-28, 2009), organized by Prof. Dragoslav Herceg and **MKNAMA** (May 23-24, 2009), organized by Prof. Djurdjica Takači.

One of the sections of the 12th Serbian Mathematical Congress, held last year at the Faculty of Sciences, was devoted to mathematics teaching.

Professors of the Group for Mathematics Teaching have participated in the work of international conferences devoted to mathematics teaching with oral presentations and posters, of which one should mention CADGME 2007, held in Pecs (Hungary), attended by Profs. Djurdjica Takači, Arpad Takači, Djordje Herceg and the others, as well as CERME 2009, held in Linz (Germany) in which participated Prof. Djurdjica Takači.

The project "Development of computer methods for teaching mathematics and natural sciences", financed by the European Union in the frame of the Cross-border Serbia-Hungary program was successfully completed. In the frame of this project, School of intensive courses was organized in the period April 4-9, 2008, taught by professors from the Faculty of Sciences: Prof. Arpad Takači (project manager), Prof. Stevan Pilipović, Prof. Dragoslav Herceg, Prof. Djurdjica Takači, Prof. Agneš Kapor, Prof. Dragan Mašulović and Prof. Ivana Ivančev-Tumbas. A valuable contribution to the School gave also professors, teaching assistants, and postgraduate students from the University of Belgrade, as well from several universities from Hungary, Bulgaria, Bosnia and Herzegovina and FYR Macedonia. It is especially worth noting that about 130 teachers of mathematics, physics, chemistry, and psychology from primary and secondary schools attended the mentioned courses. The majority of participants obtained a published book (about 500 pages) containing the courses texts.

Professors of the Department of Mathematics and Informatics are editors of several journals from the Methodology of Mathematics Teaching and visiting professors at domestic and foreign universities.

Each year are organized meetings of experts from various branches related to mathematics teaching. An example was the seminar "Mathematics, Pedagogy, Psychology", organized by Prof. Rozalija Madaras at the Faculty of Sciences, University of Novi Sad in 2007.

It should also be mentioned the devoted engagement of our professors in the work of special mathematical classes in the high school "Jovan Jovanović Zmaj", as well as active participation in the organization of mathematical competitions and work with young mathematicians – competitors.

Members of the Group

- Dr Dragoslav Herceg, full professor
- Dr Djurdjica Takači, full professor
- Professors and teaching assistants of the Department of Mathematics and Informatics

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Results

PhD theses
- D. Pešić,
- J. Tatar
- R. Stojković
- M. Miloradović
- P. Kovačević

MS theses
- J. Tatar
- R. Stojković
- J. Radovanović
- S. Zečević
- J. Maksić
- D. Nedić
- B. Prentović
- E. Ljajko
- Z. Čolakov
- M. Bozalo

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METHODOLOGY OF INFORMATICS TEACHING

The Group for Informatics Teaching Methodology at the Department of Mathematics and Informatics functions (partly) in the frame of several research projects (one national and several international) under the guidance of Prof. Mirjana Ivanović. Members of the Group are engaged in the research related to different areas of methodology of informatics teaching at all educational levels.

RESEARCH AREAS

Applying the newest trends in education and modern approaches and methodologies of presenting teaching material based on information-communication technologies, the Group proposes new ways of working in traditional and whole-life education. The Group members have developed and proposed a series of teaching systems intended for intelligent personalized learning and testing. Further development and upgrading of these systems offer the possibility of a high-quality personalized education.

In the frame of the advancement of quality of informatics teaching the Group's research is concerned with:

- Implementation of a general architecture for intelligent learning in different areas;
- Application of text mining and educational materials with the aim of personalization, recommendations for more advanced learning flows, as well as multiple use of the available teaching materials;
- Application of techniques of artificial intelligence with the aim of improving quality of educational software;
- Techniques of electronic and distance learning;
- Application of statistical methods in revealing various relations and interdependences in the educational processes.

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- Hajnalka Ignac
- Veronika Tomić Kukla
- Željko Stanković
- Marija Peurača
- Miodrag Milićević

5. Ivanović M., Budimac Z., Dudan Z.: Lifelong Learning for Small and Medium Companies in Serbia, Informatics Education Europe II, Thesaloniki 29-30 November 2007, pp. 60-67.
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LEADING OF PROJECTS

- **Learning support system with application of data-mining and data security**
  Ministries of Science of Serbia and Slovenia; 2008-2009
  Project Leaders : Prof. Mirjana Ivanović and Tatjana Welzer-Družovec, Maribor (Slovenia).
- **Web-based course-supporting and e-learning system for courses in informatics**
  WUS, Austria; 2006-2007
  Project Leader: Prof. Zoran Budimac, Faculty of Sciences, Novi Sad.
- **Joint Master Studies in Software Engineering**
  CEI University Network; Other institutions: Institute of Informatics, Faculty of Science, Skopje (FYR Macedonia), 2008-2009.
  Project Leader: Prof. Mirjana Ivanović, Faculty of Sciences, Novi Sad.

PARTICIPATION IN PROJECTS

- **Software Engineering: Computer Science Education and Research Cooperation**
  Stability pact for South-eastern Europe sponsored by Germany; 2001 – 2009
  Project Coordinator: Dr Klaus Bothe, Berlin; Coordinator for the University of Novi Sad (UNS): Prof. Zoran Budimac, Faculty of Sciences, Novi Sad.
- **Bridging the digital divide in South Eastern Europe**
  Austrian Science and Research Liaison Offices, Ljubljana and Sofia, c/o Zentrum für Soziale Innovation (Project coordinator: Sofia University, Bulgaria); 2007-2008.
  Coordinator for UNS: Prof. Mirjana Ivanović, Faculty of Sciences, Novi Sad.
- **Joint MSc curriculum in software engineering**
  TEMPUS CD-JEP-18035-2003., 2004–2008; Supported by EUROPEAN COMMISSION – TEMPUS; Consortium members: Humboldt University Berlin, Germany, University of Deusto, Bilbao, Spain; De Montfort University, Leicester, UK.
  Project Leader: Dr Klaus Bothe, Berlin (Germany).