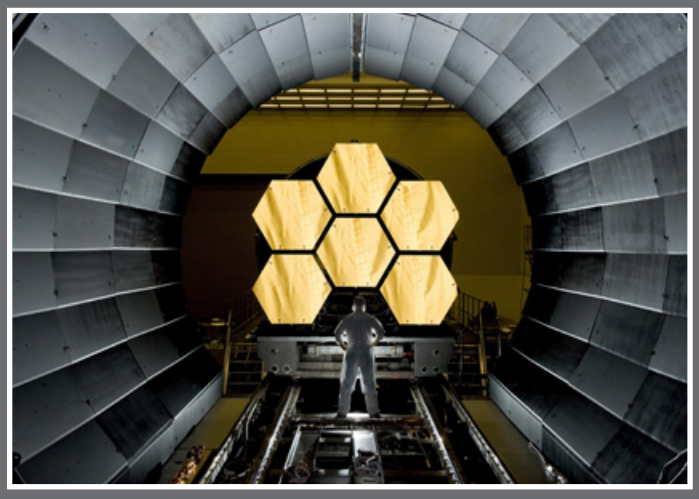
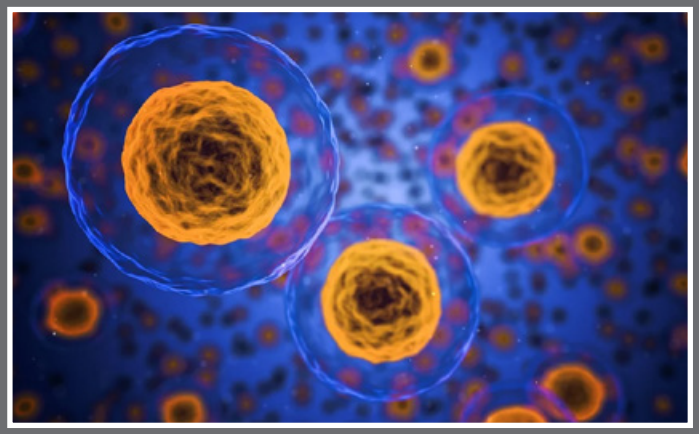
Scientific Research Centre at Sofia University "St. Kliment Ohridski"

Yearbook of Scientific Research Projects at Sofia University 2021–2022





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Sofia ● 2023
„St. Kliment Ohridski” University Press

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Yearbook of Scientific Research Projects
at Sofia University 2021-2022

Bulgarian
First edition

Editor: Eleonora Getsova

Format 70x100/8

"St. Kliment Ohridski" University Press
www.press-su.com

ISSN 1314–622X

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Vice-Rector for Research and Project Affairs
Sofia University "St. Kliment Ohridski"

The present publication is the sixth in the series of Yearbooks presenting scientific research projects at Sofia University. It presents highlights of some of the projects concluded in the last two years.

Established in 1888, Sofia University "St Kliment Ohridski" is the oldest and the largest university in Bulgaria. It is the leading Bulgarian academic and research institution ranked among the world's top 750 and Europe's top 300 universities.

Its structure comprises of 16 faculties, three departments, two institutes and over 35 centres, with over 150 bachelor and over 500 master programmes.

In the academic year 2021/2022, about 22 000 BA and MA students and almost 1 000 PhD students studied at Sofia University.

The University maintains interuniversity agreements with hundreds universities from various countries, and has hundreds of joint participations in international projects of different types and multilateral contacts with scholars from all over the world.

Sofia University is the leader in the country in terms of number of participants in the students' and lecturers' mobility and implementation of the idea of common European area in the domain of university education and research.

At present, the University employs over 1 600 full-time teaching and research staff, including a significant part of the best scientists in Bulgaria in all major areas of natural and social sciences and humanities. Currently, Sofia University produces about 20% of the scientific research output of the country.

As in previous years, project funding provided the major part of the financial support for research. This included 65% national funding, 15% – from European programmes and 20% – from industry.

The implementation of the research projects was made possible by the expertise, experience and efforts of all researchers involved, and greatly facilitated by the excellent administrative, financial and information services provided by the Scientific Research Centre of Sofia University.

Activities of the Scientific Research Centre for 2021 – 2022

The Scientific Research Centre is the department providing administrative, financial, accounting and information support to research and project activities performed on a contract basis.

Projects are funded by the National Research Fund (65%), EU Programmes (15%) and industry (20%).

A structure of the Scientific Research Centre is the Technology Transfer Office (TTO) acting as an interface between research and industry, and stimulating creation of spin-offs and development of the entrepreneurial spirit among the researchers.

The TTO is a member of the CERN HEPTech Network.

Over the two-year period (2021-2022), administrative and accounting services of over 600 contracts were provided and financial statements of 156 contracts were prepared.

The upward trend of the last years for revenues exceeding the costs remains stable demonstrating a significant increase in the revenues from national funding provided by the Ministry of Education and Science and maintaining the volume of revenues from companies.

- ❖ Project activities
  - Advice and assistance in preparation of project proposals and project reporting – 91
  - Participation in several large-scale projects under the Operational Programme "Science and Education for Smart Growth" for establishment and development of Centres of Excellence and Centres of Competence
- ❖ Information and Communication activities
  - Published 22 issues of the e-newsletter
  - Compiled, edited and published "Yearbook of the Research Projects at Sofia University 2019 – 2020" (in Bulgarian and English language)
- ❖ Technology Transfer Office
  - Two editions of the European Day of the Entrepreneur were organized and held
  - A competition "Young entrepreneur" was organised and held successfully among young researchers from Sofia University
  - Two patents were obtained and 3 new patent applications were filed
- ❖ Legal services
  - Successful re-certification under the Quality Management standard ISO
  - Ongoing assistance in the preparation of documents for public procurement procedures and contracts for supply of materials and services

Projects

Creation of a European network of national centres of competence in high performance computing, high performance data analytics and artificial intelligence (EUROCC)

Research area: Mathematics, Informatics, Computer Science

Research unit: Faculties of Natural Sciences of Sofia University

Funding institution: Horizon 2020 Programme (EuroHPC JU) and Ministry of education and science

Project duration: September 2020 –December 2022

PROJECT COORDINATOR

Prof. Dr. Ana Proykova,
Doctor Habil,
Faculty of Mathematics and Informatics

PARTNERS

33 European Partnering institutions

PROJECT OBJECTIVES

The objective of EuroCC (https://www.eurocc-access.eu/) is to establish in each of the participating 33 European countries a HPC Competence Centre as a reference and single contact point for academia, industry and public administration.

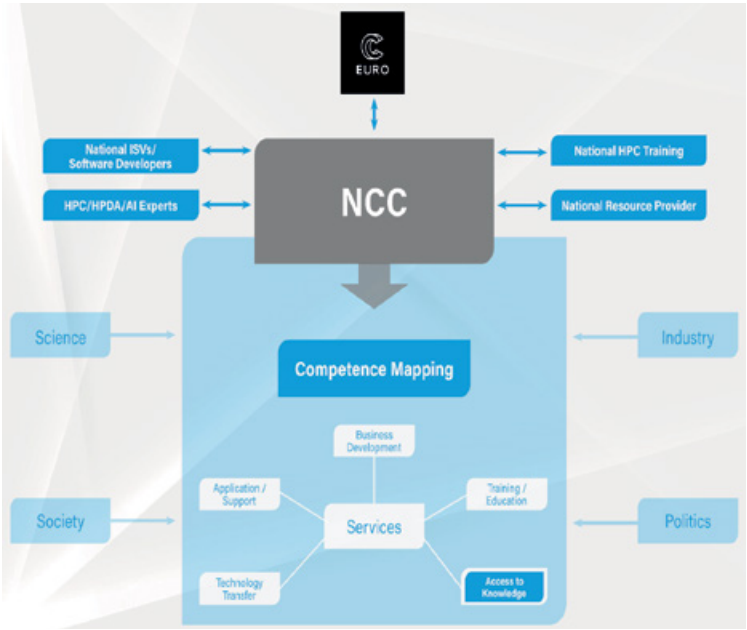
These National Competence Centres (NCCs) shall offer services to their end users that cover all needs from access to resources to technological consultancy or the provision of training courses.

As there is a diverse level of maturity of the national HPC activities, the concept of EuroCC foresees to take this into account by on one hand providing the NCCs a clear structure in terms of topics to be addressed, but at the same time keeping flexibility in the way these topics will be realized.

EuroCC´s ambition is to become the enabler of a network of National Competence Centres all over Europe. Where developments in the member/participating states have happened so far individually in a mostly isolated modus operandi, EuroCC will now realize the necessary instrument within the frame of EuroHPC to foster these developments.

OUTCOMES

At the end of the project, 33 NCCs were established in the field of high performance computing (HPC), high performance data analytics (HPDA) and artificial intelligence (AI). Each NCC was helped by the EuroCC activity to identify their baseline and maturity level of available competences and services as well as to map their user needs to enhanced or newly added services. By nature, the service approach is modular and flexible and covers a wide span from training and skills development, industrial interaction, technology transfer and access to scientific expertise and knowledge. Based on these pillars, the NCCs created a roadmap (as a living document) and they are constantly developing it by adding new services, improving some or even removing services if they do not meet the needs of the user. The national governments have mandated the organisation leading the National Competence Centre in each country – in the case of Bulgaria: IICT-BAS with partners Sofia University and UNWE. These leading organisations are the ones, which bring together experts on a national level, which take into account relevant users and set up the necessary environment to support them in the application of HPC, HPDA and AI for their respective domains.



Schematic setup of each National competence centre

APPLICATION AREAS

- Artificial intelligence applied in drive-less automotive transport
- Applications in computational physics, biology, chemistry, mathematics
- Fluidomechanics
- Plasma control
- Medicine

PROJECT BENEFITS

A system for assessment of internal reports was established and KPIs were defined and monitored. Representatives of the NCC-Bulgaria participated in all meetings, seminars, workshops, and conferences organized by EuroCC and CASTIEL (CSA-Horizon 2020 interconnected with the EuroCC via the bridging structure of champions). The collaboration and twinning activities with other NCCs continued successfully (exchange of materials and discussions with NCC Sweden, NCC Montenegro, NCC Belgium, NCC North Macedonia).

In the last two months of the EuroCC a new proposal – phase two named EuroCC2 – was prepared and approved for funding by the Digital Europe program of the framework program Horizon Europe.

The EuroCC Sofia University team leader, Prof. Dr. Proykova – opening of the training session for SMEs in the field of HPC,HPDA, AI in Burgas

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REsearch Infrastructure on REligious Studies /ReIReS/

ReIReS
Research Infrastructure on Religious Studies

Research area: Religious Studies, Digital Humanities

Research unit: Department for Cyril and Methodius' Studies, Faculty of Slavic Studies;
Centre for Slavo-Byzantine Studies "Prof. Ivan Dujčev", Faculty of Theology

Funding institution: The EU Framework Programme for Research and Innovation Horizon 2020

Project duration: February 2018 – July 2021

PROJECT COORDINATOR

Prof. Anna-Maria Totomanova, DSc
Department for Cyril and Methodius' Studies,
Faculty of Slavic Studies

PARTNERS

- Fondazione per le scienze religiose Giovanni XXIII, Italy – Coordinator
- Brepols Publishers NV, Belgium
- Consiglio Nazionale Delle Ricerche, Italy
- École Pratique des Hautes Études, France
- Johannes Gutenberg-Universität Mainz, Germany
- KU Leuven, Belgium
- Leibniz-Institut für Europäische Geschichte, Germany
- Stichting Refo500, Netherlands
- Theological University of Apeldoorn, Netherlands
- Universität Hamburg, Germany
- Uniwersytet Warszawski, Poland

PROJECT OBJECTIVES

The project concept is based on the idea that knowledge creates understanding between peoples and stems from the fact that religion and religious differences continue to be a serious problem in both Europe and the world.

The main goal of the project was to lay the foundations of a unique and high-tech European research infrastructure in the field of religious studies, which would provide answers to a number of the important questions for modern society, related to the past and the future of European civilization.

Consortium partners strive to introduce and use innovations in the selected field (new data, new tools and a new generation of researchers); to promote respect for different religions, for the past and the future; to enrich themselves through research, digital access to data, international cooperation.

All are driven by the desire to put research in service of the society and ultimately impact such important sectors such as education, public services and technology.

OUTCOMES

During the project period 2018-2021, as a starting community for the historical-religious studies we worked and laid the foundations for a sustainable European Research Infrastructure on Religious Studies. Our activities aimed at better understanding the community, offering access to training and sources, planning a stable future. We therefore focused on:

- Joint Research Activities: a set of tools has been developed for collaboration through access to partners' resources.
- Training: we offered 6 one-week trainings on the use and study of special documents and 6 courses on digital humanities and religious studies with a total of 231 participants who, overall, were quite satisfied with the program, and produced no less than 111 presentations, leaflets, etc. available on our website.
- Transnational Access: 88 TNA scholarship holders from 23 countries enjoyed a research stay at one of our libraries or archives.
- Sustainability: this required us to adapt to changing conditions, both financially, organizationally, user- and research cantered.
- ReIReS continued in two subsequent EU-funded projects – Resilience and Resilience PPP. In June 2021, Resilience was included in the European Roadmap for Science Infrastructure.

One-week training "Use and Study of Special Documents", September, 2019, Centre for Slavo-Byzantine Studies "Prof. Ivan Dujčev"

APPLICATION AREAS

All areas of Humanities related to religious studies: History, Philology, Theology, Philosophy, Sociology, Medieval Studies, Archival Science, Librarianship, Source Studies, Digital Humanities.

The project achievements can also be used in the service of society in solving conflicts and problems related to the religious identity of different communities, and for the development of relevant policies of prevention and combating religious prejudice and cases of discrimination on confessional grounds.

PROJECT BENEFITS

The Bulgarian medieval literary heritage, which is directly related to Orthodoxy, became part of the European research space and could be studied, researched and popularized with modern methods. Sofia University actively participated in the project as the organizer of Training for the study of specialized documents and of a course in Digital Humanities on medieval Slavo-Byzantine material, which received high scores from the participants.

The study visits, during which foreign scientists got to know the manuscript collections of Sofia University, were also highly appreciated. The Bulgarian participants gained experience of participating in European projects financed and managed by the European Strategic Forum for Research Infrastructures.

Course "Digital Resources for Slavonic-Byzantine Studies", November, 2019, Sofia University.

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An innovative platform for smArt adaPtive videO GamEs for Education /APOGEE/

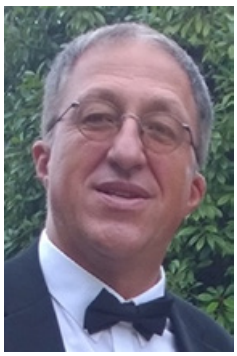
Research area: Natural sciences, Mathematics and Informatics, Computer sciences

Research unit: Department of Software Technologies, Faculty of Mathematics and Informatics

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – June 2022

PROJECT COORDINATOR



Prof. Dr. Boyan Bonchev, Vice-Dean,
Department of Software Technologies,
Faculty of Mathematics and Informatics

PROJECT OBJECTIVES

The APOGEE project aims to create and practically validate an innovative open software platform for constructing intelligent adaptive video games for learning, which includes:

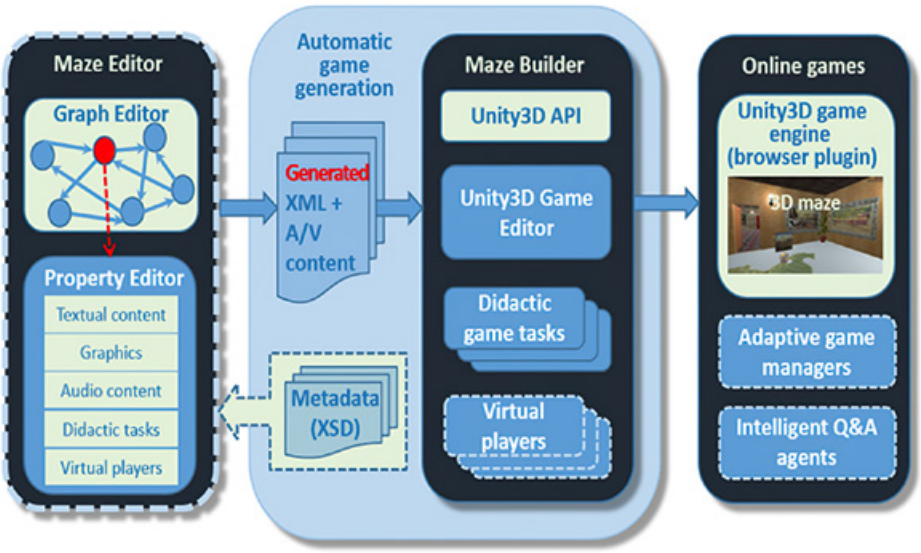
- Building, automatically generating and customizing educational video games based on a development methodology and a formal descriptive model, including semantic structuring of game and learning content
- Dynamic adaptation of the characteristics of the created educational video games according to the current results, and also according to the excitement and emotional state of the individual player, recognized by methods of artificial intelligence
- Intelligent virtual 3D players answering the player's questions by providing knowledge and facts about a given question drawn from lexical corpora of didactic content such as textbooks and web pages
- Validation of the methodology and the platform for creating intelligent adaptive video games through practical experiments with educational games on Bulgarian medieval history, in order to evaluate the usability of the platform by non-IT professionals, and on the other hand, the possibility of playing and learning through intelligent adaptive maze video games built through the platform

OUTCOMES

For the two stages of the project implementation, 42 papers were published (10 in journals), the total impact factor is IF=21.25 (for 6 publications), and the total impact rank is SJR=8.354 (for 21 posts). Of the 31 scientific conference papers published for the two stages, three have won a prize for the best paper at the conference, and one has been nominated for such a prize. In addition to the 42 scientific publications described at https://apogee.online/results.html, a utility model was developed and was approved by the Patent Office of the Republic of Bulgaria, as well as an application for a utility model was submitted and is in process of review.

During the project implementation, one dissertation, five graduation theses were elaborated and the following products were created:

- Maze Builder – a software product for generating educational maze-type video games
- A hardware device for measuring player excitability by skin conductance
- A software module for recognizing player arousal
- Demonstration educational games-mazes on the medieval history of Bulgaria



The APOGE software platform enables the creation of serious maze-type educational video games enriched with:

- *2D and 3D mini-games – puzzles of different types (word puzzles, sorting, grouping, memorizing, matching, shooting, etc.)*
- *Realistic and intelligent virtual players (NPC's) answering real player's questions*

APPLICATION AREAS

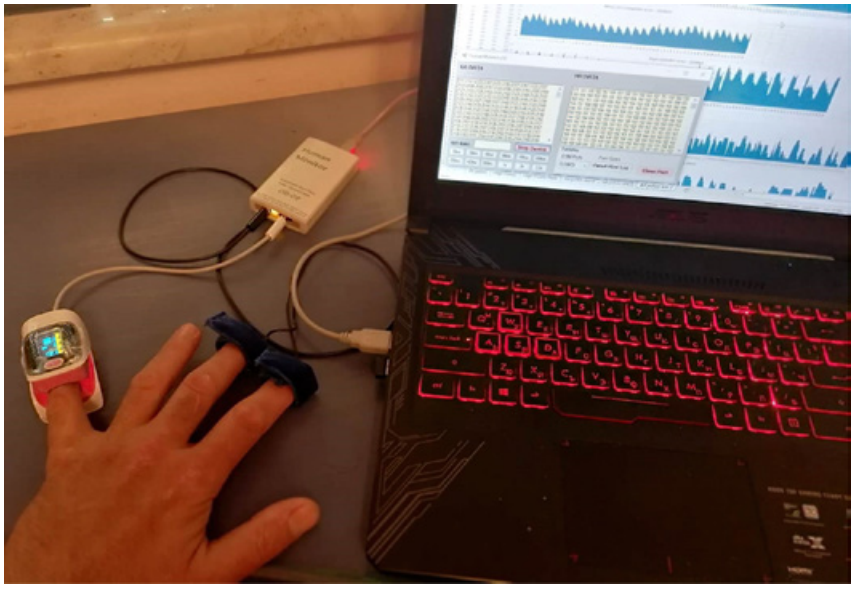
All types of results are used for further improvement of the APOGEE platform and for the generation of educational video games in the following directions:

- Video game design and analysis tools
- Recognize and track player emotions
- Adaptive behaviour control of the virtual player (NPC) in an educational game based on the recognized emotional state of the real player
- Recognizing player emotions to adaptively manage game complexity to improve user experience and learning
- Customized content based on player characteristics
- Intelligent services for the creation of personalized serious games

PROJECT BENEFITS

The following educational 3D video games have been created with the APOGEE platform:

- Within the framework of the APOGEE project: Asenevtsi – a demonstration educational game-maze on the medieval history of Bulgaria (basic and customized version)
- Within the framework of project BG05M2OP001-1.001-0001 – Construction and development of Centre for excellence "Heritage BG": educational video game about the heritage of Valchan Voivode
- Within the Erasmus+ project KA2 2020-1-NL01-KA203-064610 – Education for Climate Resilient European Heritage Architecture': two educational video games about the preservation of cultural-historical heritage in the conditions of climate change.



A useful model named "Electronic device for measuring skin conductance". It is an electronic device for measuring absolute skin conductance as part of a system for detecting the change in emotional excitability of an individual. In particular, the utility model describes a device that, via a specialized protocol, sends data to a computer system with specialized software to detect a change in an individual's excitability and make subsequent decisions based on the detected change.

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Big Data innovative solutions for Smart Cities (Big4Smart)

Research area: Mathematical sciences and Informatics

Research unit: Faculty of Mathematics and Informatics

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – June 2022

PROJECT COORDINATOR

Prof. Dessislava Petrova-Antonova,
Faculty of Mathematics and Informatics

PROJECT OBJECTIVES

Most cities understand the smart city concept. Many of them are working on strategies for its implementation, and more and more are taking concrete actions to deploy "smart" solutions. This raises two questions: *"What are the challenges for a city to become smart?"* and *"What does a city do to become smart?"* Their answers require an assessment of the effectiveness of "smart services" in cities and of the social effect of implementing "smart solutions" in the transition from a "smart" plan to a "smart" process. In this context, within the proposed project "Big Data Innovative Solutions for Smart Cities" (Big4Smart), indicators for performance assessment of smart cities have been developed, which provide the following opportunities:

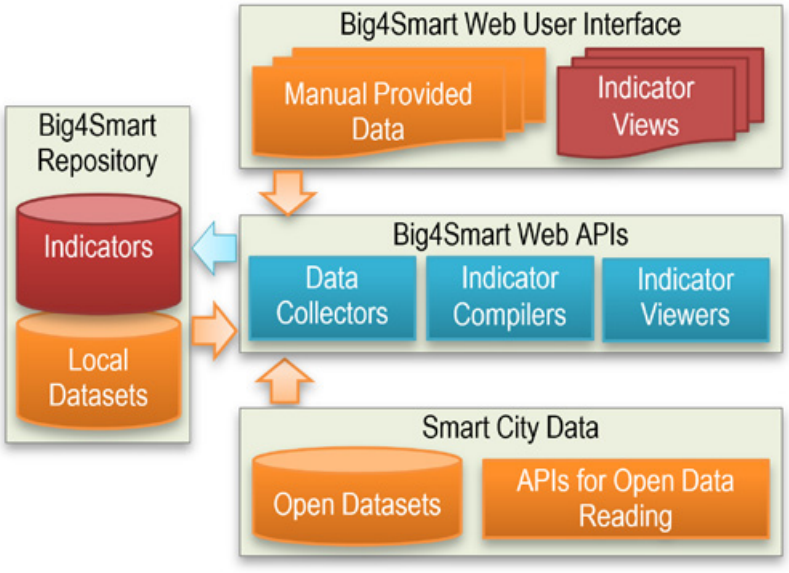
- Quantitative progress assessment of the implementation of smart city strategy
- Feedback on the efficiency of current policies
- Timely and informed decision-making
- Increased understanding of future challenges
- Identification of best practices to be followed in other cities

OUTCOMES

A total of 1152 smart city indicators (SCIs) are analysed, and a classification scheme is elaborated, including six thematic areas: Smart Nature, Smart Living, Smart Mobility, Smart Governance, Smart People and Smart Economy. A conceptual model has been developed to support understanding the semantics of the indicators for assessing smart cities in terms of space, time and calculation method. A unified algorithm following the conceptual model has been proposed for calculating the values of the indicators. Datasets with the necessary qualitative characteristics for calculating indicators for the assessment of smart cities are elaborated, including new datasets obtained from integrating the existing ones.

A technological framework for developing the 3D city semantic model is implemented as a common platform. The platform provides interactive visualisation of various indicators and characteristics of urban objects. Algorithms for assessing walkability and air quality have been developed.

A software platform for monitoring, collecting, aggregating and visual analytics of air quality data from various sources has been developed. The platform's functionality is divided into two software applications – a monitoring application, which collects and aggregates data, and an application for visual data analysis.



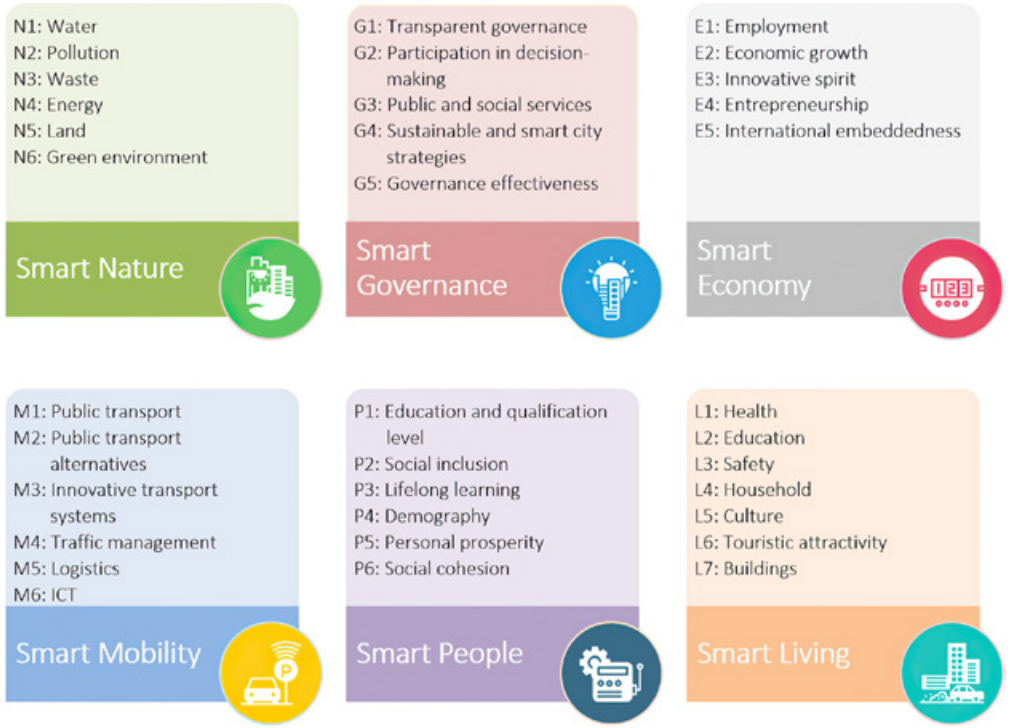
Big4Smart platform architecture

APPLICATION AREAS

Assessing the performance of smart cities and supporting decision-making by stakeholders working on sustainable cities development.

PROJECT BENEFITS

The CSIs elaborated within the project enable cities to assess their transition to equitable, sustainable, and liveable cities. The proposed technological platform for assessment of the city's "smartness" provides an indicator framework that supports quantitative progress evaluation of smart city strategy implementation, feedback on the efficiency of current policies, timely and informed decision making and increased understanding of future city challenges. It can benefit local authorities, citizens, businesses, investors, and regional and national authorities.



Classification scheme of smart city assessment indicators

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Development of a method for radiation treatment plan evaluation based on radiobiological criteria

Research area: Physical sciences

Research unit: Laboratory "Dosimetry and Radiation Protection", Department of Atomic Physics, Faculty of Physics

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – November 2021

PROJECT COORDINATOR

Prof. Dobromir Pressyanov, PhD, DSc,
Laboratory of Dosimetry and
Radiation Protection,
Department of Atomic Physics,
Faculty of Physics

PROJECT OBJECTIVES

Further development and study of models describing the dose-response relationship in the irradiation of tumors and normal tissue, as well as their adjustment to data from the clinic or from experiments with laboratory animals.

Update and further development of Matlab based module for evaluation of radiotherapy plans based on radiobiological criteria.

An additional part to the module will be the implementation of a methodology for comparing radiotherapy plans, which would allow the evaluation of the plan based on individual models, estimating the probability of tumor control or the probability of normal tissue complication, even when model parameter values are not available for the specific patient.

OUTCOMES

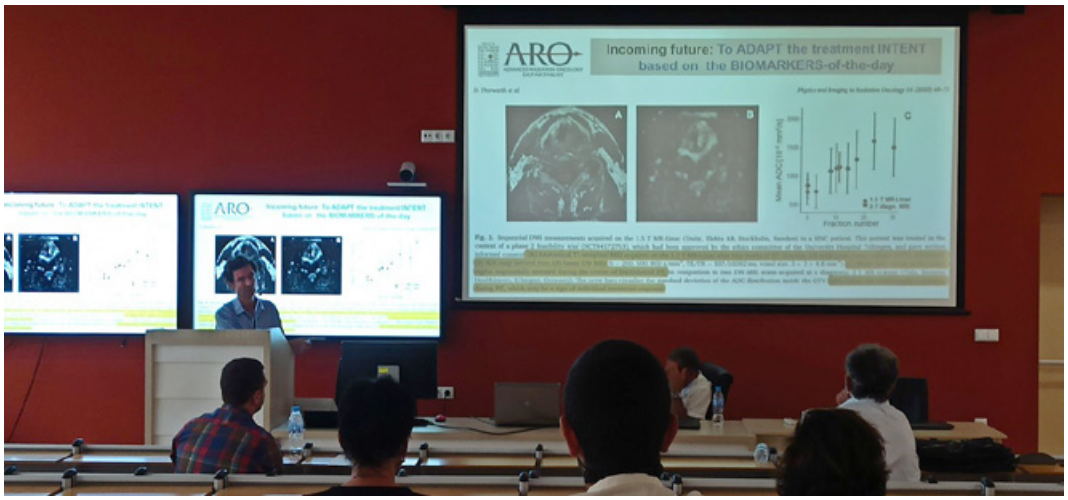
Model study of the effect of different time fractionation schemes on the probability of tumor control based on the Zeider-Minerbo-Stavreva (ZMS) and Ruggieri-Nahum models.

Application of the ideas of ranking plans to investigate the influence of different model parameter values on TSR under different time fractionation schemes.

Analysis of the prostate database of patients treated with high dose rates has been completed. A TCP/NTCP evaluation module has been developed reading the dose-volume data from the file exported from the treatment planning system, available for download from the project site.

Clinical data from high dose rate brachytherapy published by Swedish researchers for different time-fractionation schemes has been analysed using the Zeider-Minerbo-Stavreva TCP model.

Matlab software is developed to estimate the probability of tumor control and normal tissue TCP/NTCP complication for a high dose rate brachytherapy case. Some aspects of the pioneering Linac-MR technology have been investigated, namely the dose accuracy in extended duration radiation sessions where we have an extension of the duration of the treatment session.



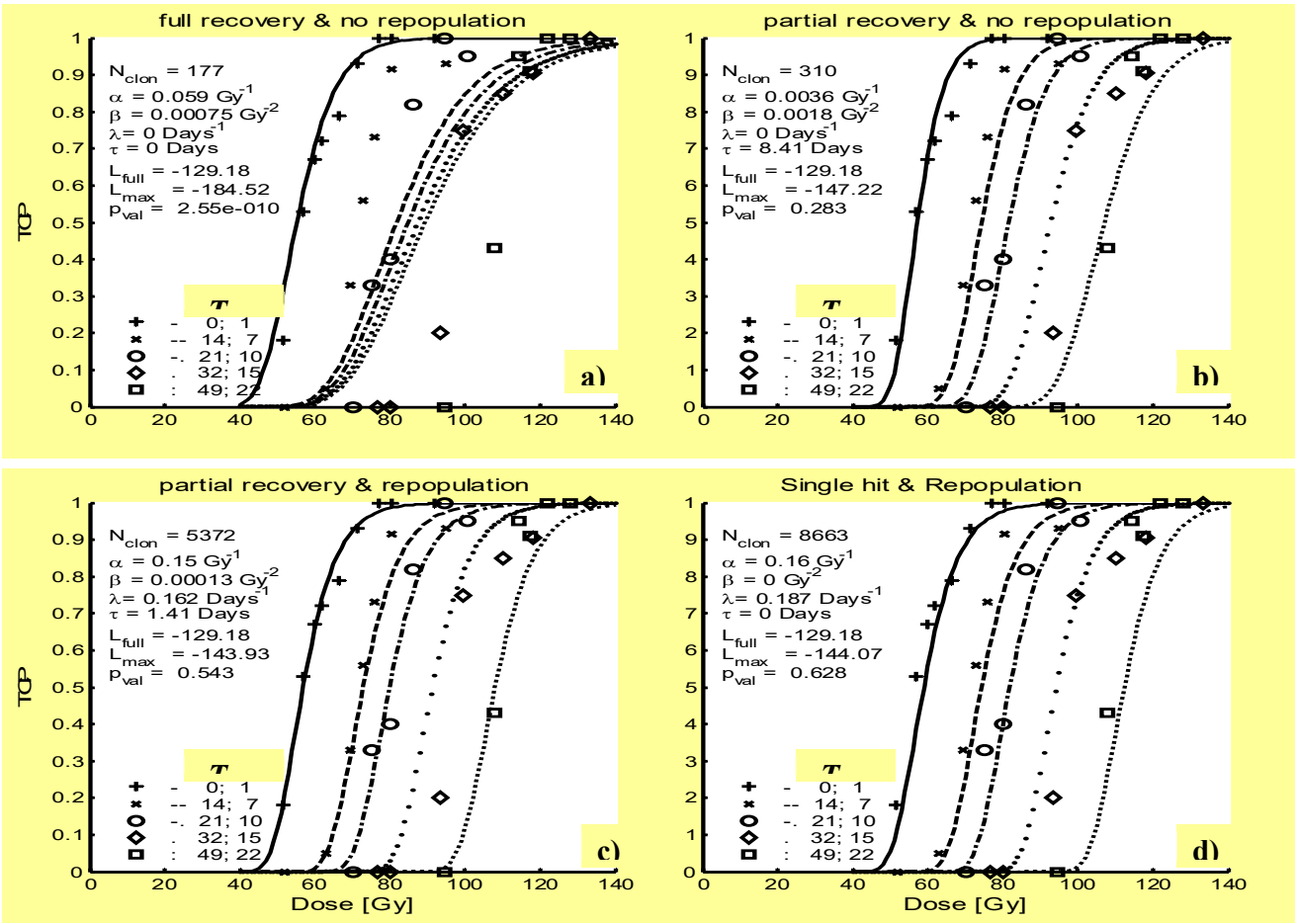
Presentation of project research results by Professor Ruggieri, Italy

APPLICATION AREAS

Medical physics, Medicine (radiotherapy), Biophysics, Radiation biology

PROJECT BENEFITS

By modelling the probability of tumor control and the risk of therapy-related adverse complications, it is possible to increase the quality of treatment and to improve the prognosis of patients undergoing radiation therapy.



Model results for tumor control probability (TCP) obtained within the project research.

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Multilevel laser-induced continuum structures

Research area: Atomic and Molecular physics

Research unit: Department of Theoretical Physics, Faculty of Physics

Funding institution: Bulgarian National Science Fund

Project duration: January 2020 – May 2022

PROJECT COORDINATOR

Kaloyan Zlatanov, PhD,
Department of Theoretical Physics,
Faculty of Physics

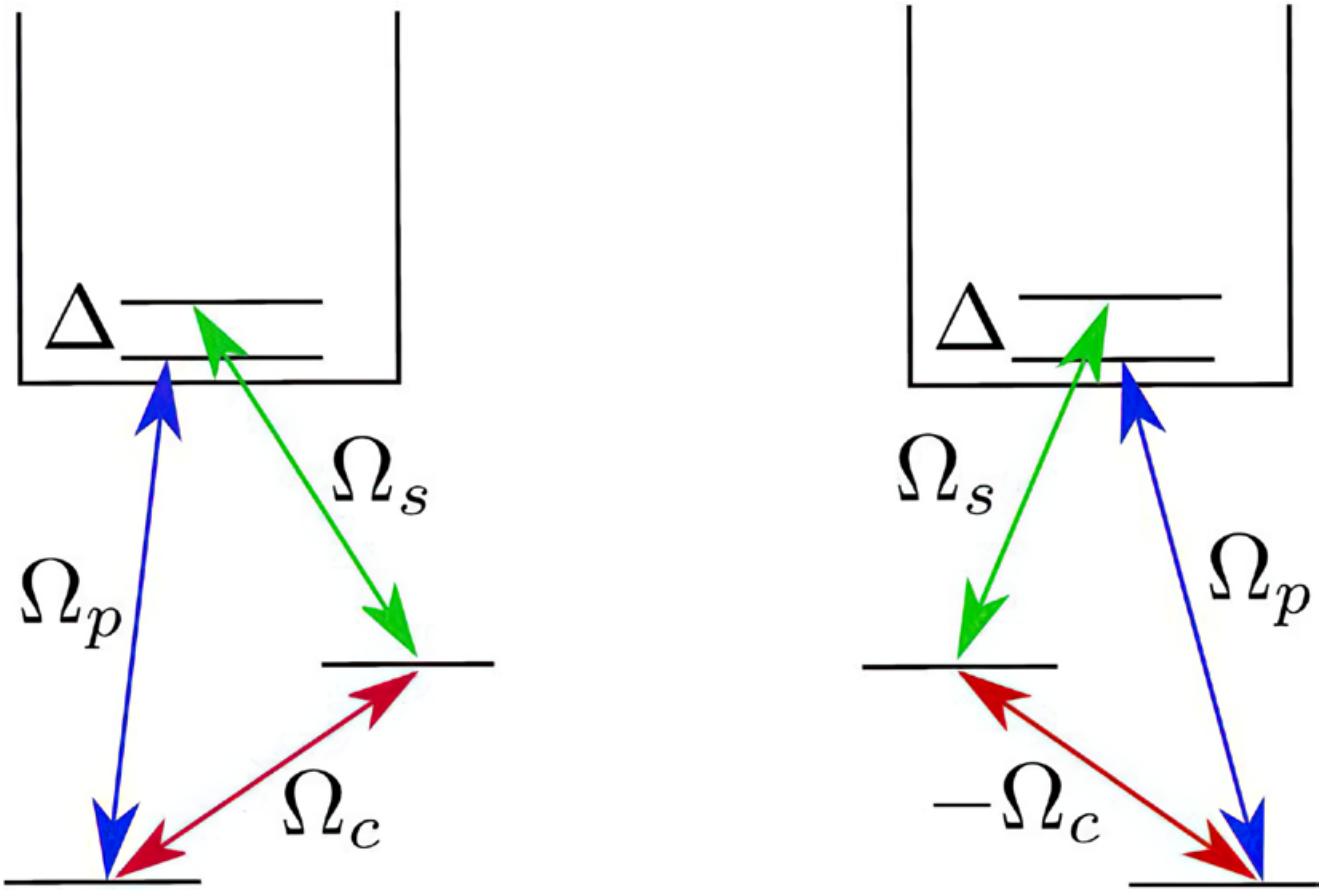
PROJECT OBJECTIVES

The aim of the project was to develop the theoretical apparatus for treating multilevel Rama transitions through a continuum state.

The objectives were to develop novel techniques for studying atomic and molecular structures by ionization and to construct a novel method for chiral resolution based on asymmetric ionization in the enantiomers.

OUTCOMES

We derived a connection between the number of states involved in the interaction and the ionization profile of the system thus giving a method that can study the systems' internal structure. We also developed specific excitation scheme that generates asymmetric ionization within enantiomers and thus resolves them.



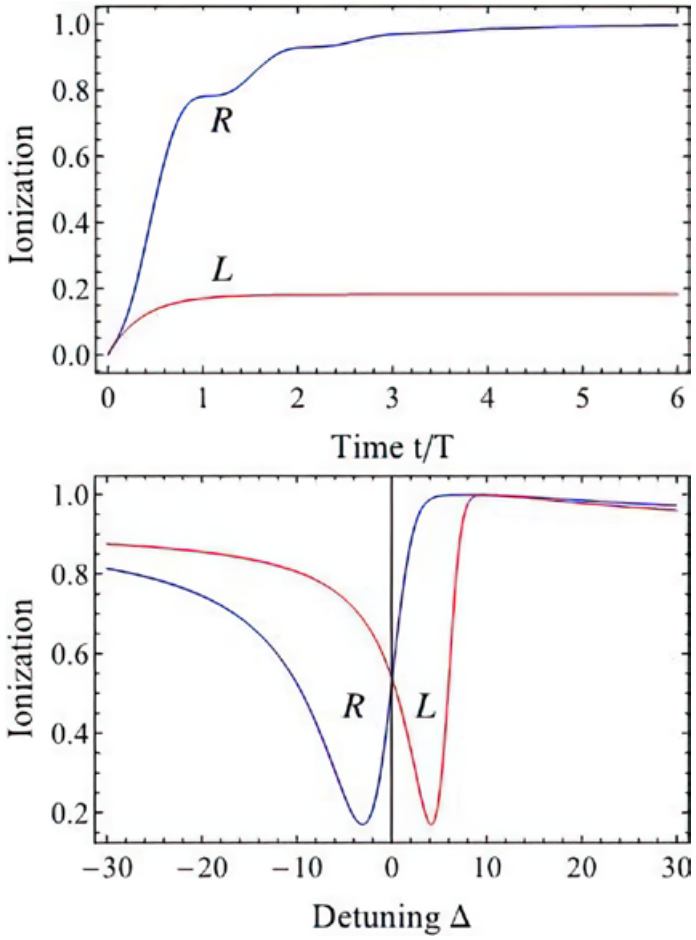
Cyclic Raman transition of bonded states in the basic and high energy levels through a state of continuum

APPLICATION AREAS

The results constitute a significant improvement of ionization techniques like REMPI (resonance enhanced multi-photon ionization); since REMPI completely ignores the presence of other states close in energy to a level amplifying the ionization signal. Thus the results of the project can advance ionization physics as well as chiral resolution techniques.

PROJECT BENEFITS

The results can be applied in ionization physics, spectroscopy and chemistry.



Fano profiles setting the ionization profile of the system as a function of time (upper graph) and the two-photon detuning (lower graph). Clearly proper laser settings can resolve the enantiomers.

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Bridge for researchers in danger going to Europe – STEP II (BRIDGE II)

Research area: Research support activities

Research unit: Centre for Information Society Technologies, Faculty of Mathematics and Informatics

Funding institution: The EU Framework Programme for Research and Innovation Horizon 2020

Project duration: December 2018 – February 2021

PROJECT COORDINATOR

Prof. Krassen Stefanov,
Centre for Information Society Technologies,
Faculty of Mathematics and Informatics

PARTNERS

- Bielefeld University, Germany – Coordinator
- University of Gothenburg
- ETH Zurich
- Austrian Agency for International Cooperation in Education and Research
- Faculty of Mechanical Engineering, University of Niš
- Centre for Research & Technology, Hellas
- University of the Aegean

PROJECT OBJECTIVES

The BRiDGE II project is implemented within the EURAXESS network with a view to supporting the careers of 300 highly skilled refugee researchers and their integration into European labour markets. It provides guidance, mentoring and training for refugee researchers in Greece, Bulgaria, Serbia, Austria, Switzerland, Germany and Sweden. It aims to meet their individual career planning needs by providing 300 career development plans, supporting 190 academic and 90 industrial mentors, and EURAXESS staff.

Within the project, 4 trainings, 4 webinars and 2 networking events were provided for refugee researchers, 2 trainings and 2 networking events for academic and industrial mentors, as well as relevant webinars to improve collaboration. Four peer groups have been established and 45 internships/months have been provided for refugee researchers, training of EURAXESS staff and provision of course materials, guidance and tools for further use.

The project partners support diversity as a value in society and fight against prejudice and discrimination against minorities in academia and society. The long-term integration of refugees into the labour market is an important step towards achieving this and benefits many aspects of society.

OUTCOMES

The qualitative results of the project include:

- Consulted about 100 refugee researchers from Asia, Africa, Europe and South America, resettled all over Europe and the Middle East
- Involved about 30 mentors from all over Europe
- The contact persons are engaged in the EURAXESS network
- Trained around 60 refugee researchers
- Funding provided under an internship program in industrial research organizations and NGOs for 10 refugee researchers
- List of contact persons and organizations for refugee assistance in the partner countries
- Newsletters and success stories for raising awareness

European Researchers' Night 2019 – side event for refugee kids

APPLICATION AREAS

The EURAXESS network consists of over 1500 contact persons in over 600 scientific organizations based in 43 European countries. The online tools, materials, video blog and reports developed and provided to the contact persons of the EURAXESS network, as well as the training conducted with them, enable a better and effective assistance to refugee scholars.

PROJECT BENEFITS

The project benefits can be described in the direction of the target groups – refugee researchers, contact persons of the EURAXESS network, scientific organizations in the academic and non-academic environment.

In general, the results of the project increase the possibilities for a more effective integration of refugee researchers in the European labour market.

Common initiative – Caritas BG and Sofia University – IT for beginners course for refugees

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21st century skills for changing the approach to university teaching

Research area: Science, Technology, Engineering and Mathematics (STEM), Higher Education

Research unit: Centre for Information Society Technologies, Faculty of Mathematics and Informatics

Funding institution: Human Resource Development Centre, Erasmus+

Project duration: September 2019 – November 2021

PROJECT COORDINATOR

Prof. Krassen Stefanov,
Centre for Information Society Technologies,
Faculty of Mathematics and Informatics

PARTNERS

- Fundacion Universidad San Jorge, Spain
- Smarthink Srl, Italy
- Egitim Ve Genclik Calismalari Enstitusu Dernegi, Turkey
- Ceska Zemedelska Univerzita v Praze, Czech Republic
- Pamukkale Universitesi, Turkey

PROJECT OBJECTIVES

21st Century Skills (Critical Thinking, Collaboration, Communication, Creativity & Innovation, Self-Direction, Establishing Global Connections, Establishing Local Connections, Using Technology as a Tool for Learning) are crucial for the quality of education and training. All educators, researchers and the labour market agree on the importance of the mentioned skills, but there is a lack of teaching materials and methodology.

The main objective of the project is to increase the quality of higher education institutions (HEI) in the EU in teaching 21st century skills to support better understanding of qualifications and better use of all available skills in the European labour market.

The specific objectives are:

1. To elaborate specific and innovative teaching materials and educational model for teaching of 21st Century Skills for HE teaching staff
2. To promote cooperation between the labour market and HEI organizations
3. To establish an online learning platform to support the development of 21st century skills for HE staff and students at EU level

OUTCOMES

During the project, 3 intellectual outcomes were achieved:

- IO1: Market research of 21st Century Skills and didactic guideline
- IO2: Training course on 21st Century Skills and teaching materials
- IO3: Learning Management Systems (LMS) and Website

The project results are listed below:

- IO1
  - 21st Century Skills Market Research (four national reports, appr. 40 pages each)
  - Didactic Guideline – 26 pages
- IO2 – 21st Century Skills Training Course and Teaching Materials – Book, 288 pages
- IO3- Learning Management Systems (LMS) – Website and course testing
- 1 short term staff training (25 participants)
- 5 classes of 21st Century Skills in the partner universities (100 students will participate)
- 1 international market research report
- 4 newsletters
- 6 national multiplier conferences (280 participants)
- Social media accounts of the project (Facebook, Linkedin, Instagram, Twitter)
- Dissemination and exploitation report
- Evaluation reports (2)

The Project Newsletter

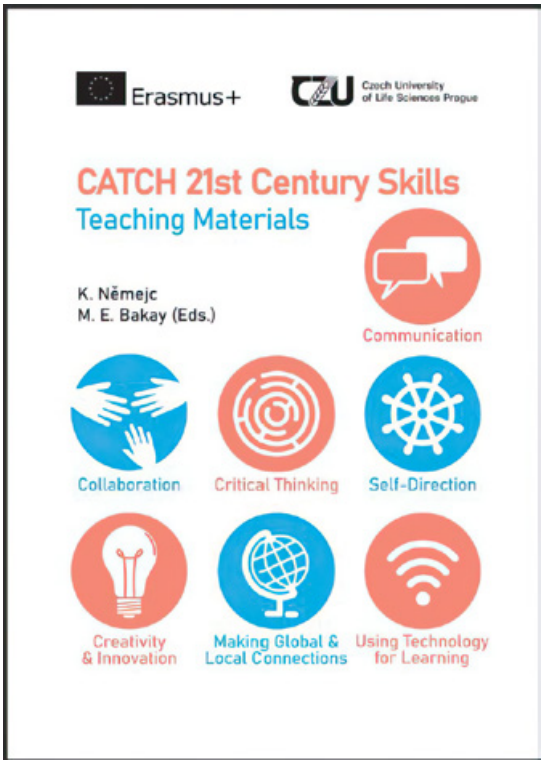
APPLICATION AREAS

The results are applicable for the implementation of a constructivist approach to developing 21st century skills in students from different professional fields. The developed course has a place in both Bachelor and Master training programs.

The project results show that these students respond better to the demand of the labour market and are more competitive when applying for jobs and career development.

PROJECT BENEFITS

- A methodological guide for the implementation of a constructivist approach in higher education
- A course has been developed – methodology, structure, content, activities, exam materials, in 4 languages, including Bulgarian, to develop 21st century skills
- The course in the Bulgarian language is presented in electronic format in the university learning content management system Moodle and can be repeatedly reused by different faculties in different disciplines
- An archive of the course in the English language is provided, which can be imported into LMS Moodle platforms. A printed methodical guide for teaching it is published



Methodological textbook cover

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EURAXESS network hubs – piloting EURAXESS talent hubs to support researchers' careers

Research area: Research support actions

Research unit: Centre for Information Society Technologies, Faculty of Mathematics and Informatics

Funding institution: The EU Framework Programme for Research and Innovation Horizon 2020

Project duration: September 2021 – August 2022

PROJECT COORDINATOR

Prof Krassen Stefanov,
Centre for Information Society Technologies,
Faculty of Mathematics and Informatics

PARTNERS

- Bay Zoltan Alkalmazott Kutatasi Kozhasznu Nonprofit Kft (BZN) – Coordinator
- 23 partners

PROJECT OBJECTIVES

The "EURAXESS Hubs" project mobilises a critical mass of both experienced and less experienced EURAXESS Bridgehead Organisations, at tailored-made levels of involvement, to launch three pilot EURAXESS hubs and then share their experience within the network.

EURAXESS hubs are integrated digital platforms for thematic, cross-border, competence-based collaboration of EURAXESS Centres (ESCs) and other stakeholders, such as multiplier and enabler organisations outside of the EURAXESS network, in engaging and providing services to researchers, research organisations and other network service centres (SCs).

Pilot hubs will be implemented and validated in three thematic areas:

- Talent management in academia and the public sector
- Researcher careers beyond academia
- Scientific start-up entrepreneurship

During the implementation, the hubs will actively engage with the targeted stakeholders; will roll out pilot services that are scaled to the operation of the hub and are based on already available tools and expertise; finally, as a result, will produce digital toolkits, each toolkit showcasing the respective hub's area of operation and enabling the adoption of the hub based service model by further ESCs.

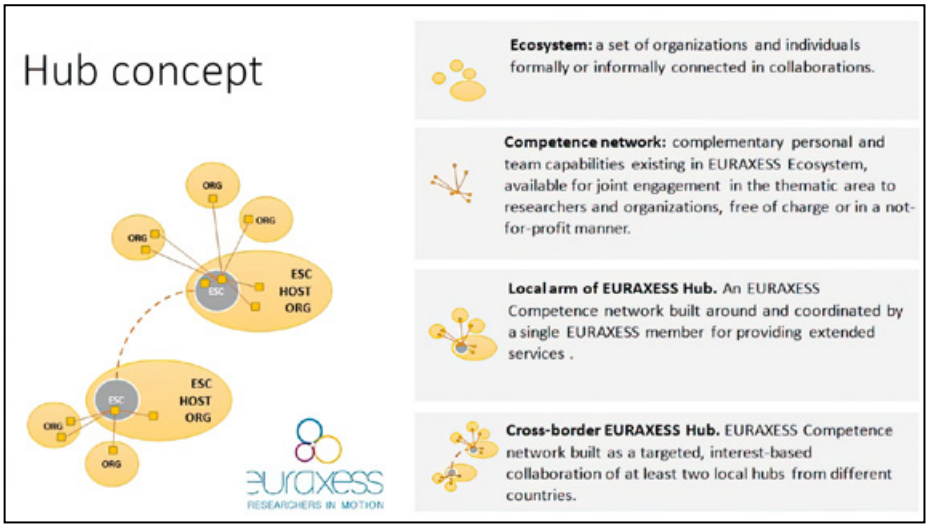
OUTCOMES

The project team has created a set of online tools and materials for the formation of the 3 envisaged hubs, which can be viewed at:

- https://www.euraxess.gr/greece/talent-management-hub
- https://www.euraxess.es/spain/euraxess-researcher-careers-beyond-academia-digital-toolkit
- https://www.euraxess.rs/serbia/euraxess-startup-hub-digital-toolkit

As additional materials are added the following:

- Good practices in the recruitment of scientific researchers
- Career stories of successful scientists
- Eighty pairs of scholars participating in REBECA – the network's industrial mentoring program
- Podcasts based on successful scientific careers https://euraxess.ec.europa.eu/worldwide/asean/euraxess-smart-talks-podcast-series



EURAXESS-Hubs Concept

APPLICATION AREAS

The activities and results of the project will be widely disseminated, with the prospect that the established cross-border centres will remain operational after the end of the project. The digital toolkits developed will be intended for use by each EURAXESS centre interested in implementing this new service delivery architecture, either by joining existing centres or creating additional ones after the end of the project.

PROJECT BENEFITS

The project benefits are in the structured and enriched content and tools to support researchers during their mobility and career development. Eighty scientific researchers were supported with career guidance.

EURAXESS-Hubs Scientific start-up tour-Luxembourg 2022

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Strengthening the efficiency and optimizing the services of all partners in an innovative and open EURAXESS NETWORK – EURAXESS TOP IV

Research area: Research support actions

Research unit: Centre for Information Society Technologies, Faculty of Mathematics and Informatics

Funding institution: The EU Framework Programme for Research and Innovation Horizon 2020

Project duration: September 2018 – February 2022

PROJECT COORDINATOR

Prof Krassen Stefanov,
Centre for Information Society Technologies,
Faculty of Mathematics and Informatics

PARTNERS

- Center for Research and Technology Hellas (CERTH) – Coordinator
- 32 partners

PROJECT OBJECTIVES

The EURAXESS TOP IV project consortium includes partners from 34 countries, covering the whole EURAXESS network. The project is divided into 8 work packages. WP2 (Career Development), WP3 (Social Integration Initiatives) and WP4 (Engagement with industry) aim to address the expanding of the services. WP7 (EURAXESS Open to the World) aims to attract third country researchers to Europe contributing to brain circulation, while WP5 (Capacity Building of the EURAXESS Network), WP6 (Network support and a comprehensive communication and cooperation strategy for EURAXESS) and WP8 (Open EURAXESS portals) aim at the deepening of existing services through trainings, networking and updating of national EURAXESS portals.

Based on the project results and the future trends in the ERA, a strategy and vision for EURAXESS to the year 2030 has been provided within WP 9 "Future of the EURAXESS Network – New Services"

The project impact is related to increasing the visibility of the EURAXESS Network and diversifying the services provided by the EURAXESS Service Centres with increased quality in order to improve the career development of researchers, in favour of responsible HORIZON 2020 research and innovation.

OUTCOMES

As a result of the large-scale and creative work of the team, despite the difficulties during the pandemic, the project ended up with much better results than expected. Some of the most important are as follow:

- Training materials for scientists and contact persons in the areas of "soft" skills development and scientific entrepreneurship created and tested
- Over 450 (1/3 of all) network contacts trained
- Over 530 scientists from all over the world trained
- Seven-hundred and seventy scientists from all over the world are attracted to the mentoring program, mentoring couples – 180
- Nearly 130 young scientists and doctoral students tutored to work with mentors from industry

EURAXESS TOP IV project team

APPLICATION AREAS

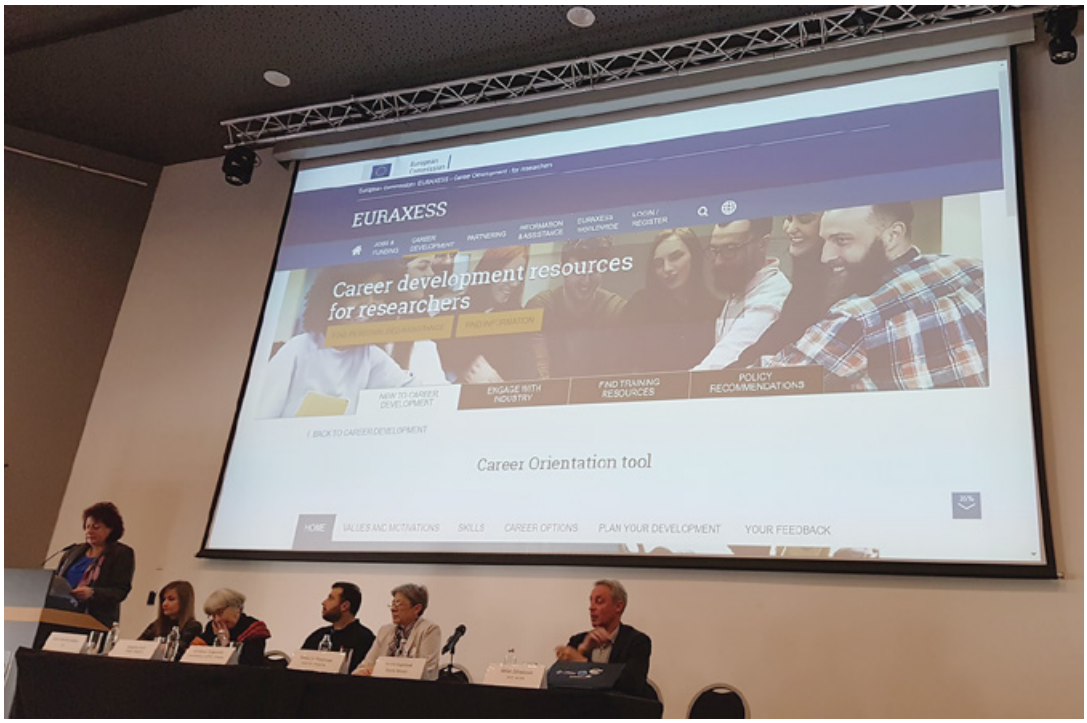
The project results can be applied in the direct work of over 1500 contact persons of the network located in over 600 scientific organizations in 43 countries in Europe:

- In career guidance of scientists
- When providing training to scientists
- For services related to the integration of foreign scientists

PROJECT BENEFITS

The project benefits are long-term and can be combined in three directions, according to the target groups – scientists, academic and industrial organizations:

- Better career development of scientists,
- More effective career guidance for scientists
- A more informed and conscious career choice of scientists
- More advanced services for scientists and organizations from the academic and industrial spheres
- Deeper interaction of scientists with industry



Network training in Borovets, 2019

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An innovative software platform for big data learning and gaming analysis for a user-oriented adaptation of technology enhanced learning (APTITUDE)

Research area: Mathematical Sciences and Informatics

Research unit: Faculty of Mathematics and Informatics

Funding institution: Bulgarian National Science Fund

Project duration: December 2018 – November 2022

PROJECT COORDINATOR

Prof. Milen Petrov, PhD
Department of Software Engineering,
Faculty of Mathematics and Informatics

PROJECT OBJECTIVES

The APTITUDE project contributed to three main EU priorities measuring the challenges of learning in the digital age: (1) better use of digital technologies for teaching and learning; (2) developing relevant digital skills and competences for digital transformation; and (3) improving education systems through better data analysis and forecasting.

The APTITUDE project aims to create and validate an innovative learning software platform for analysing of big data of learning and game data produced by modern e-learning platforms and educational games, for recommending and adapting learning content and activities in technology supported learning.

OUTCOMES

The results obtained from the activities carried out within the work packages can be summarized as benchmarking and analysis of the needs of the target users for recommendations and adaptation of learning content and learning activities:

- Specification of data extracted from learning management systems from educational games
- A repository built for storage and processing of the collected data
- Ontology and collection of rules for the educational structure in a learning management system and for educational games
- Model of the software architecture

The project has laid a good foundation for a small scientific infrastructure consisting of two servers and allowing both the maintenance of the project results, the dissemination of project results among the public through the support of a project website, and the possibility of starting new research for the development of both software systems and tools for application in education and for the extraction, storage and processing of big data.

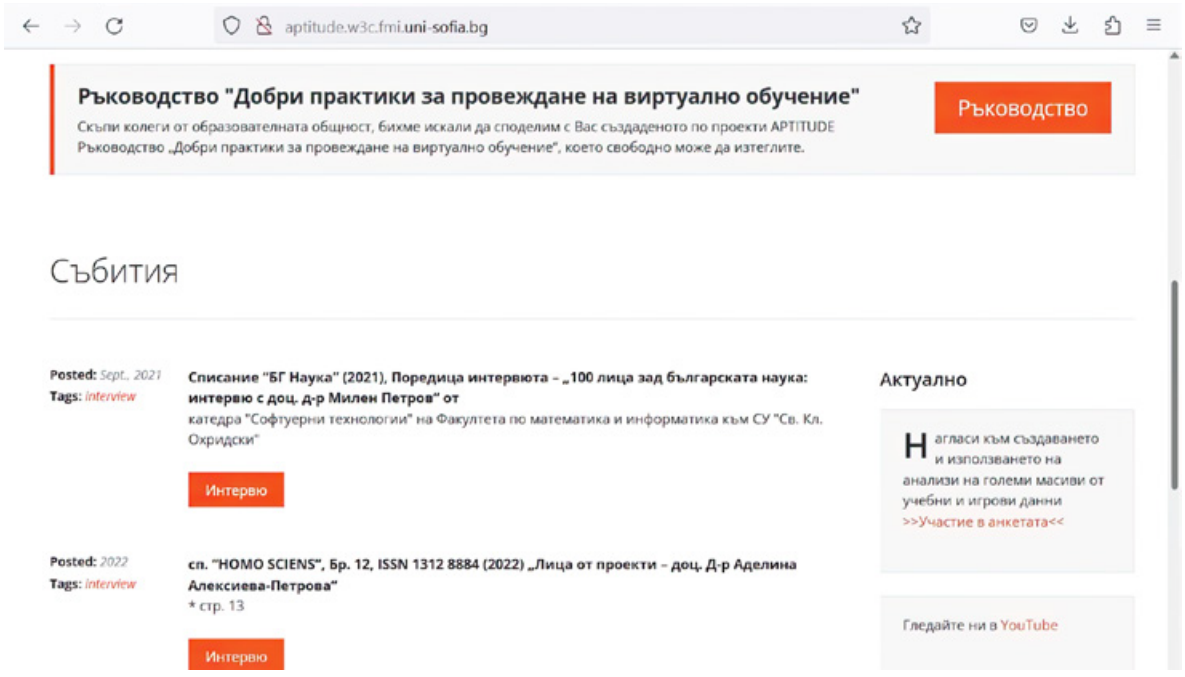

Fig.1 Information portal of the project

APPLICATION AREAS

Informatics, Software engineering, E-learning

PROJECT BENEFITS

Significant benefits were achieved in implementing the project activities that support the use of digital technologies by both teachers and learners, thereby enhancing their skills and competences in this area. This is evidenced by the open access publication of the Good Practices Guide for Virtual Learning, which, instigated by the COVID-19 pandemic, the project team decided to make available the lessons learned and results of the project work and disseminate them to the teachers of the 25th Primary School "Dr. Beron".

Fig. 2 shows the different types of actions by context of an learning activities, separated by student attendance rate.

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Political uses of the Bulgarian Revival period: Historical heritage and modern times

Research area: Social studies

Research unit: Research Centre for Social Studies, Department of Sociology

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – May 2022

PROJECT COORDINATOR

Assoc. Prof. Milena Iakimova, DSc
Research Centre for Social Studies,
Department of Sociology,
Faculty of Philosophy

PROJECT OBJECTIVES

The project aims to systematize the discursive and visual representations of the Bulgarian Revival in order to distinguish its symbolic from its indexical uses, which includes a description of the institutional but also the civic uses by different actors.

This interdisciplinary project is based on the empirical observation that the legacy of the Bulgarian revival functions as a language used both in the governmental attempts to legitimize itself in society and by critics of this government who seek to delegitimize it.

Accordingly, in situations that are perceived as crisis situations, the frequency of Revival references increases. And besides, these references are being wrapped up in populist language that resonates with social discontent in a peculiar way – turning it from a political quest to solve a problem into a complaint.

At the same time, the meanings of these references are reshaped and oscillate between martial-revolutionary, on the one hand, and tribal-moral, on the other.

OUTCOMES

The complexity of identity constitution in the interplay of political and cultural processes are scrutinized and analysed with respect to social discontent, national-populist appeals and cultural consumption. The various mobilizing potentials of the Renaissance heritage are systematized – towards solidarity, towards social criticism, but also towards shaming and delegitimizing various elites and groups – political as well as professional. This systematization is the result of field sociological research and the creation and analysis of several types of archives, including a media archive in Bulgarian and Macedonian languages.

The generalized conclusion shows the correlation between the use of iconic identity figures as metonymies for collective identity and the worsening of the public debate and the media environment and the rise of hate speech.

Empirical indicators were developed to distinguish inclusive patriotism from exclusive nationalism. An empirical link has been established between the exclusionary models of representation, which include the Revival as a cultural heritage, and the intellectuals' sense of social declassification.

Covers of volumes containing papers and essays with research results

APPLICATION AREAS

The applicability of the results is in two planes: a) as a methodology for quantitative analysis of media data and media discourse and b) as a method for assessing the impact of policies. The indicators for distinguishing inclusive patriotism from exclusive nationalism can be used in the preparation and evaluation of textbooks.

The link between the exclusionary models of representation and the intellectuals' sense of social declassification can be used to predict the rise of exclusionary nationalisms.

The revival and the high moments of the historical past are interpreted in moral rather than political terms, which points to the need for special training of school teachers for teaching civic education so as to overcome the opposition between morality and institutions.

PROJECT BENEFITS

The results became the basis of 22 publications, presented at four national and two international conferences and are the basis for updating the curriculum of three bachelor's and two master's courses.

49 students took part in the field work on the sociological research. Five MA students participated in the processing, analysis and interpretation of the data.

The research results were presented within the European Civic Education initiative in three workshops with teachers of history and philosophy, who will also teach civic education.

A Bulgarian-Macedonian network was set up to hold a joint conference "Politics, Justice, History: Sharing Heritage".

Cover of a volume containing papers and essays with research results

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Design and experimental validation of chimeric antisense oligonucleotides as antibacterial agents

Research area: Medical sciences

Research unit: Faculty of Biology

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – June 2022

PROJECT COORDINATOR

Prof. Robert Penchovsky, Ph.D.
Department of Genetics,
Faculty of Biology

PARTNERS

Department of Medical Microbiology, Medical University, Sofia

PROJECT OBJECTIVES

The project continues a very successful research in the field of RNA synthetic and computational biology, medicine and pharmaceutical started by the project leader Prof. Dr. Robert Penchovsky several years ago as a postdoctoral fellow at Yale University.

The main goal of this project is to design antisense oligonucleotides, which are directly binding and regulating the target bacterial pathogen's riboswitches. The riboswitches are structured RNA domains usually residing at the 5'-untranslated region of messenger RNAs that directly bind specific metabolites. They serve as logic gates regulating gene expression. As a result, riboswitches enable mRNAs to regulate their own expression without the need of any regulatory proteins. This way, the essential metabolites for the bacteria will not be synthesized by the cell or transported into the cell from the extracellular matrix. The result is the death of Staphylococcus aureus for instance. Antisense oligonucleotides show bacteriostatic effect and can be tested as novel antibacterial agents in bacterial isolates and human embryonic kidney cell lines (HEK 293) for toxicity.

OUTCOMES

The results of the research under the project are published in 20 publications (with an impact factor of 84 points and Q1-4 of 274 points, and 86 citations so far). Their list is available here: https://penchovsky.atwebpages.com/research.php?page=13.

During the period of the project, doctoral students and young scientist have participated in 3 international conferences with 2 presentations and 4 posters in Bulgaria and Austria (14th National Congress of Microbiology with international participation and German Bioinformatics Conference, Vienna, Austria).

Sixteen pieces of software have been written and now are available for free hare: https://penchovsky.atwebpages.com/applications.php.

Four Ph.D. students and 1 master student defended successfully their theses, all under the guidance of the project coordinator – Prof. Dr. Robert Penchovsky. The grant received the highest possible rating. This research grant was funded with only €61,000.

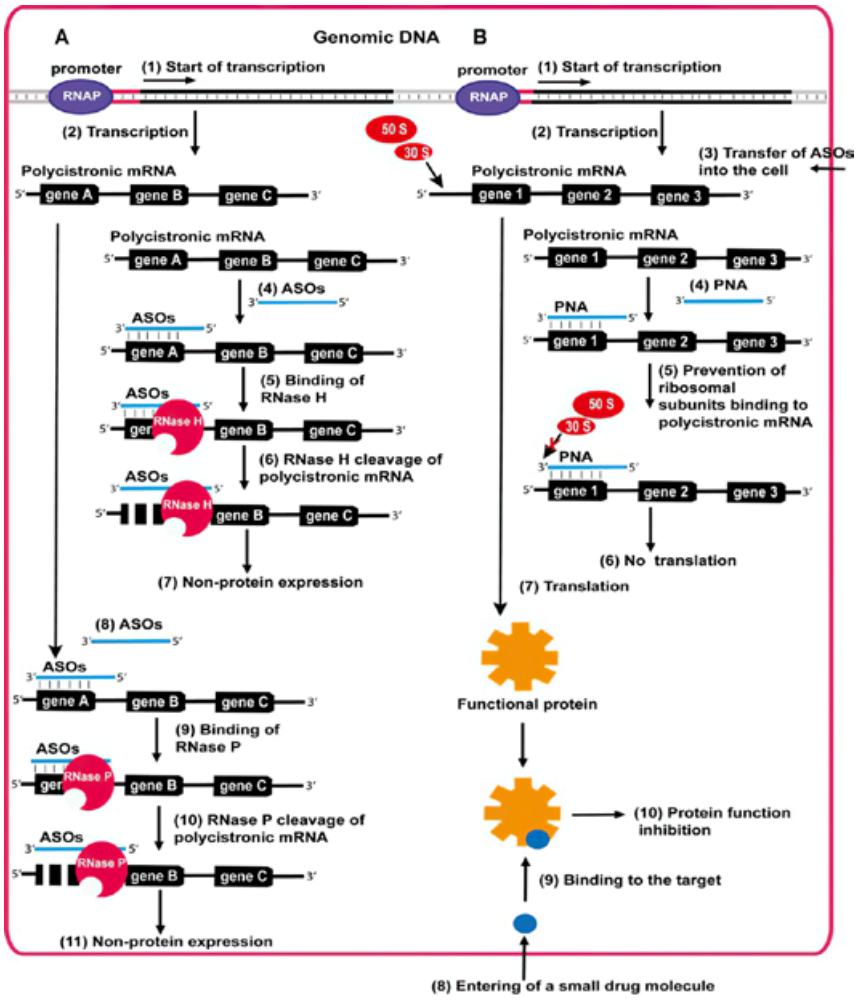
Project team members (from left to the right): Dr. Katya Popova, Dr. Nikolet Pavlova, Dr. Martina Traykovska and Dr. Lozena Otcheva

APPLICATION AREAS

The developments achieved by the project are applicable in a very wide range of fields. Those of greatest importance are human healthcare, pharmaceuticals and medicine, due to the possibility of antisense oligonucleotides being used as potential drug candidates to counter the enormous social and global problem of antibiotic resistance in bacteria.

PROJECT BENEFITS

Our main contributions are in the development of a method for the precise design of chimeric antisense oligonucleotides, which allows their specific targeting to a region (riboswitch or other mRNA) of a specific human pathogenic bacterium or group of bacteria, including multi-drug resistant bacteria, with a shown antibacterial effect without affecting the probiotic bacteria of the human microbiome.



Mechanisms of actions of ASOs

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Environmental impact assessment of waste water treatment plants on receiving water bodies

Research area: Chemical sciences;
Biological sciences (additional research area)

Research unit: Faculty of Chemistry and Pharmacy

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – December 2021

PROJECT COORDINATOR

Prof. Stefan Tsakovski, PhD,
Department of Analytical Chemistry,
Faculty of Chemistry and Pharmacy

PARTNERS

University of Architecture, Civil Engineering and Geodesy

PROJECT OBJECTIVES

The major goal of the project is to assess the impact of wastewater treatment plants (WWTP) on the receiving surface water bodies. In order to achieve this goal following major tasks are proposed:

Establishing of a monitoring net for assessment of the WWTPs impact on the receiving water bodies (quality indicators and number of WWTPs) based on chemometric analysis of data from the control monitoring of WWTPs and expert assessment based on the ecological and chemical status of the receiving water bodies.

Performing of own monitoring for assessment of the impact of WWTPs on the receiving water bodies including not only the traditional physicochemical and chemical indicators for surface water quality but also an assessment of the ecotoxicity of the samples using ecotoxicological tests.

Performing of ionomic studies of the plant species used in the PhytotoxkitF™ bioassay.

Environmetric assessment of the impact of WWTPs on the receiving water bodies and the ionom of the studied plant species by applying the chemometric approaches: principal component analysis (PCA), pattern recognition method (MCR) and partial least squares method with discriminant analysis (PLS-DA).

OUTCOMES

The chemometric analysis performed on the mandatory monitoring of data of 39 WWTPs in Bulgaria identified three factors (sources) responsible for the data structure: "soluble nutrients", "refractory loads" and "suspended solids". Groups of similarity between WWTPs were identified and a monitoring scheme for the impact assessment of WWTPs on the receiving surface water bodies was determined.

The multivariate statistical analysis on the self-monitoring data showed that:

- The wastewaters are characterized by higher electrical conductivity and higher concentrations of P, N, Cl-, Zn, Se, while surface waters – by higher levels of total suspended solids and Fe
- Surface waters after WWTP outlets are characterized by higher values of Cl-, Zn, Se, pH, and lower Mn
- The discharge of WWTPs do not significantly affect the receiving surface water bodies
- Growth inhibition of *Heterocypris incongruens* appeared to be the most sensitive ecotoxicological parameter
- The calculated accumulation coefficients showed that *Sinapis alba* preferentially accumulated Cr, Pb, Sb, U; *Sorghum saccharatum* – Al, Cr, Sb, Tl, U; and *Lepidium sativum* – Ni, Pb, Sb

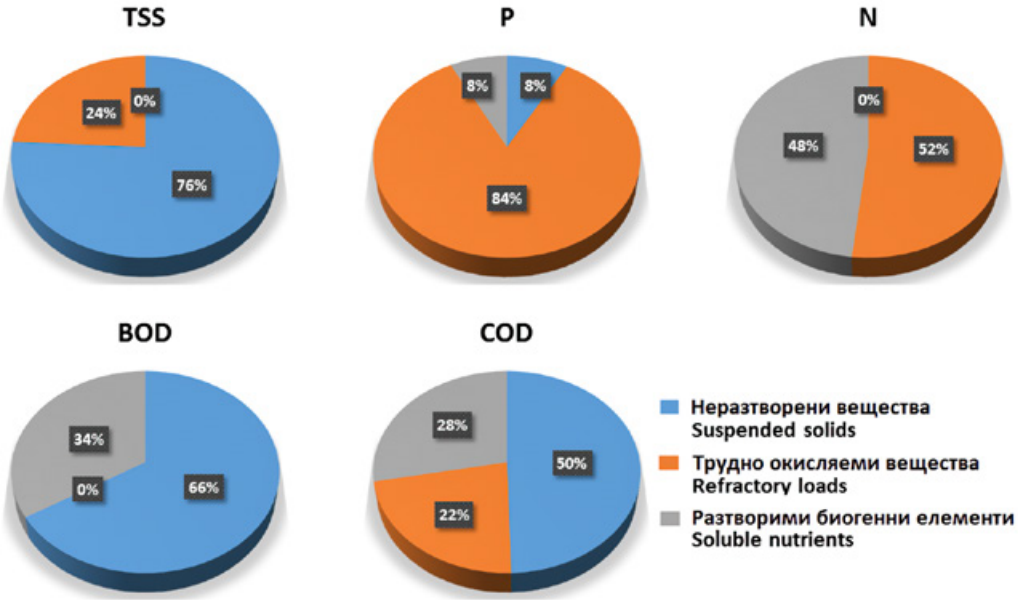

Fig. 1 Average source contributions to WWTP effluent loads.

APPLICATION AREAS

The results of the project could be applied in the WWTPs and water resources management in Bulgaria using the obtained:

- Load profiles of each WWTP – they provide specific information on the composition of discharged wastewaters, which could be used to manage wastewater treatment processes and analyse the impact of WWTPs on receiving surface water bodies
- An elemental footprint of the impact of WWTPs on the surface water bodies into which they discharge
- Accumulation coefficients – to prepare an assessment of the degree of contamination of surface waters with potentially toxic elements

PROJECT BENEFITS

The successful implementation of the project resulted in:

- Prioritization of the surface water quality indicators in Bulgaria
- Proposal of an appropriate ecotoxicological tests for surface water monitoring
- Multivariate models for assessment of the impact of WWTPs on the receiving water bodies and plant species used in the PhytotoxkitF™ bioassay
- Characterization of the ionome of the investigated plant species
- Formation of a competitive research unit able to solve risk assessment tasks

The project outcomes could help stakeholders to find sustainable water management solutions for prevention of ecological and human health issues.

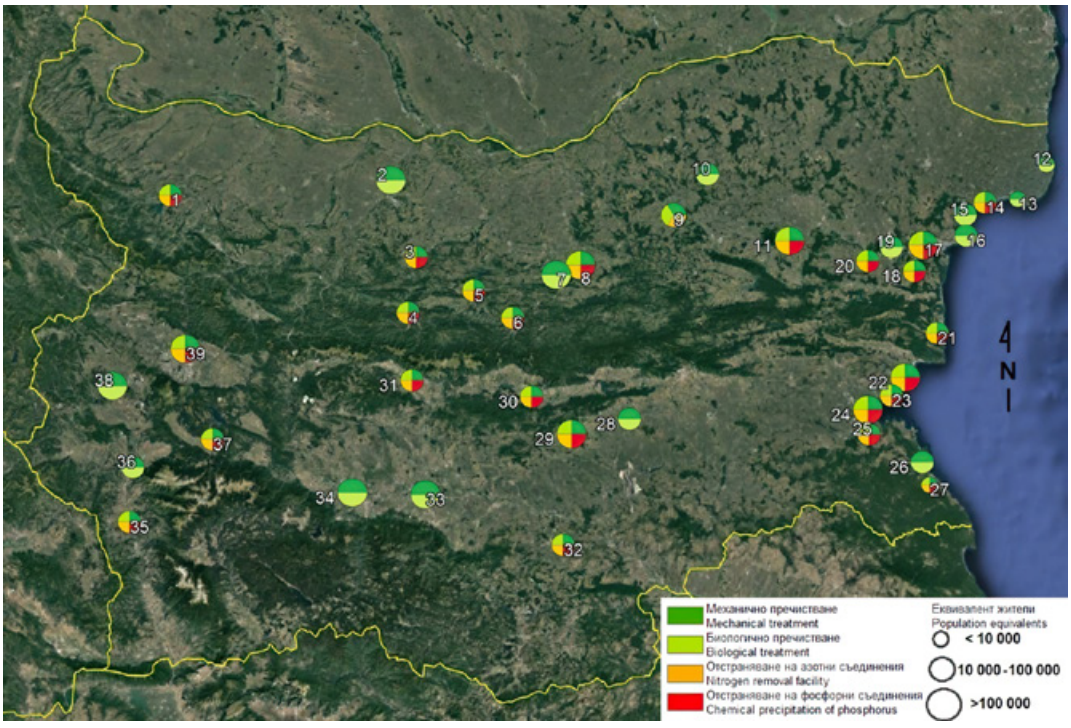

Fig. 2 Sampling map of the 39 WWTPs included in the chemometric analysis. The input dataset contains the average month loads for 2017 of chemical oxygen demand (COD), biochemical oxygen demand (BOD), total N (N), total P (P) and total suspended solids (TSS) for the studied WWTPs.

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Bulgaria on the edge of Christianity, Paganism and Heresies. The old Bulgarian translation of the *Discourses against the Arians*

Research area: Humanities

Research unit: Faculty of Slavonic Philology

Funding institution: Bulgarian National Science Fund

Project duration: December 2018 – November 2022

PROJECT COORDINATOR

Prof. DSc Tatyana Slavova,
Dept. of Cyril and Methodius Studies,
Faculty of Slavonic Philology

PROJECT OBJECTIVES

The project is a fundamental interdisciplinary study from a linguistic and historical point of view of one of the most important and early sources of Christian thought in Bulgaria – The Old Bulgarian translation of Oratio I contra Arianos by Athanasius of Alexandria.

The text has come down to us in ten Russian copies from 15th to 17th centuries, all of which preserving the colophon of Tudor Doksov, according to which the translation was done by Constantine of Preslav in year 906.

For the first time in Paleo-Slavic studies, the Old Bulgarian translation of the Oratio I contra Arianos, as one of the earliest and most significant monuments of theological thought in Christian Bulgaria, is being studied comparatively and comprehensively – in historical, orthographic-punctuational, morphosyntactic, lexical-lexicographical, word-forming and stylistic aspects.

OUTCOMES

A collective monograph in two volumes was prepared: *Атанасий Александрийски. Първо слово против арианите. Т. I. Издание на текста. ISBN 978-954-07-5546-5, 432 p. Т. II. Изследвания. ISBN 978-954-07-5547-2, 303 p. УИ "Св. Климент Охридски". София, 2022.*

The first volume of the book is a bilingual edition (Old Bulgarian and Greek) of Oratio I contra Arianos, an Old Bulgarian – Old Greek index dictionary, and an Old Greek – Old Bulgarian word index. The critical edition of the Old Bulgarian translation of Oratio I contra Arianos is prepared on the basis of all ten existing manuscript copies (Pogodin 968, 1489), one of the earliest ones, has been chosen as a base manuscript.

The left page of the edition presents the Greek text with variant readings and apparatus criticus. The text is published with the purpose of shedding light over the specific features of the Old Bulgarian translation and reconstructing the hypothetical manuscript used by the Old Bulgarian translator. The Old Bulgarian – Old Greek index dictionary is a thorough study of the lexis of Oratio I contra Arianos after the base manuscript. It contains a description and grammatical analysis of a total of 6881 Old Bulgarian word forms with 20659 occurrences, organized in 1920 dictionary entries.

The second volume of the book includes studies on the Old Bulgarian translation of the Orationes contra Arianos.

Cover of the monograph Атанасий Александрийски. Първо слово против арианите. Т. I. Издание на текст. St. Kliment Ohridski University Press Sofia, 2022.

APPLICATION AREAS

The Old Bulgarian – Old Greek index dictionary of Oratio I contra Arianos is used in the electronic Historical dictionary of the Bulgarian language, based on the Histdict platform (http://histdict.uni-sofia.bg/dictionary/search).

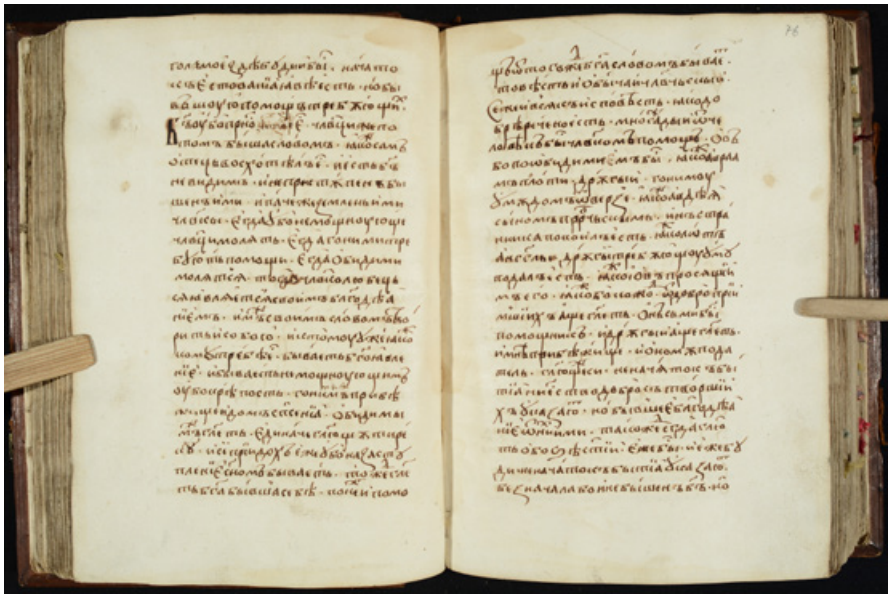
The digital text uploaded to the Diachronic Corpus of the Bulgarian language (http://histdict.uni-sofia.bg/textcorpus/list) will allow the processing of the text for new studies in the fields of Old-Bulgarian language, History of the Bulgarian Language, Medieval Slavic text linguistics studies, philology, theology, history, philosophy, patristics, Slavic studies, Cyril and Methodius studies, Byzantine studies, etc.

PROJECT BENEFITS

The Old Bulgarian text of the Oratio I contra Arianos has been uploaded to the Diachronic corpus of the Bulgarian language Histdict (https://histdict.uni-sofia.bg/textcorpus/list) and is freely available to the general public (https://histdict.uni-sofia.bg/textcorpus/show/doc_257).

The site of the project (https://cyrillomethodiana.uni-sofia.bg/arianihome) located on the Cyrillomethodiana portal (https://cyrillomethodiana.uni-sofia.bg) has been updated and maintained together with the Cyrillomethodiana portal itself.

At the end of the project, an international final conference was held with the participation of well-known scholars in the field of Christianity and heresies, where the results of the project were presented.



Folio 60b from a manuscript with the Old Bulgarian translation of the Athanasius of Alexandria's Orations against the arians from the Russian State Library, collection of the Volokolam Monastery, F.113, 437, year 1488.

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Saccharomyces cerevisiae quiescence – smart model for toxicological and stress response research

Research area: Biological sciences

Research unit: Laboratory Applied Microbiology, Department General and Industrial Microbiology, Faculty of Biology

Funding institution: Bulgarian National Science Fund

Project duration: December 2017 – December 2021

PROJECT COORDINATOR

Assoc. Prof. Ventsislava Petrova, PhD,
Laboratory Applied Microbiology,
Department General and Industrial Microbiology,
Faculty of Biology

PARTNERS

- Institute of Biodiversity and Ecosystems Research – BAS
- Institute of Organic Chemistry with Centre of Phytochemistry – BAS

PROJECT OBJECTIVES

The main goal of project "*Saccharomyces cerevisiae* quiescence – smart model for toxicological and stress response research" (https://www.sacego.com/) is to demonstrate that quiescent *S. cerevisiae* cells represent an adequate model of higher eukaryotic cell when studding cellular response to different toxic and stress agents.

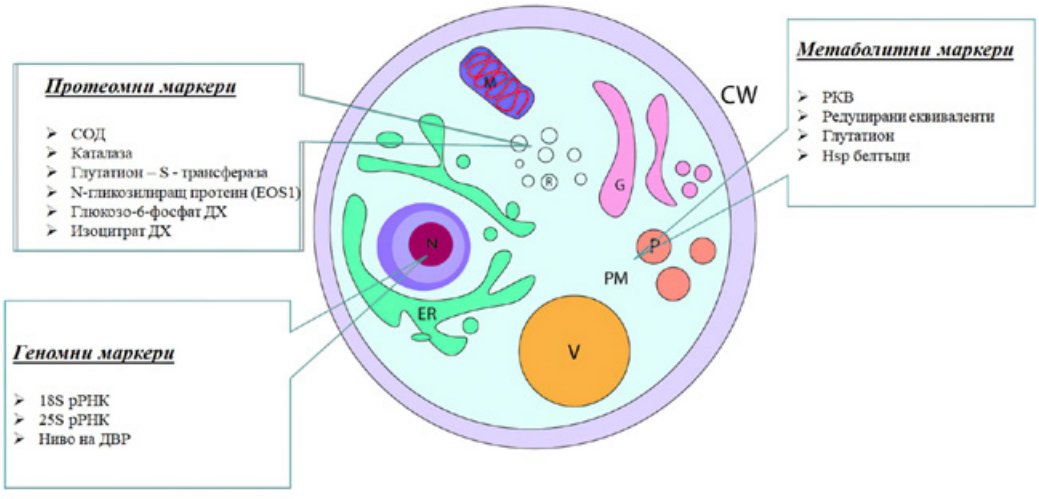
The performed study aims to further use of quiescent yeast cells for development of a novel biotest system.

It is based on molecular investigation of metabolic set of processes induced after exposure to exogenous harmful compounds.

OUTCOMES

The project implementation achieves a number of important outcomes with scientific, methodological and practical application:

- A successful methodological approach has been developed to obtain and isolate *S. cerevisiae* quiescent (Go) cells
- A thorough characterization of the obtained experimental Go cultures has been made with respect to their morphological and physiological features
- The adaptive response of *S. cerevisiae* model quiescent cultures was studied and genotoxic and DNA damaging potential of various toxic compounds was determined
- Valuable information has been obtained regarding the effect of various toxic agents on the regulation of RNA polymerases and the level of rRNA in the eukaryotic cell
- Proteomic profiles of proliferating and Go cells have been generated
- Genes and proteins that play key roles in entering and exiting the Go cell cycle in yeast have been studied and their corresponding homologues in humans have been identified
- Comparative "Physiological Profiles" of *S. cerevisiae* cells in different phases of the cell cycle have been developed



Smart in vitro model for toxicology studies in S. cerevisiae quiescent yeasts (Go)

APPLICATION AREAS

This research project addresses fundamental principles of molecular microbiology and bioinformatics of eukaryotic cellular response to toxic compounds.

Its focus is in compliance with the Priority area "Health and quality of life, biotechnology and organic food" of the National Research Strategy, as well as with the section priority of the EU Framework Programme for Research and Innovation "Health, Demographic Change and Wellbeing", namely to improve our understanding of the causes and mechanisms underlying health, healthy ageing and disease.

PROJECT BENEFITS

Based on all the research carried out within the project "*Saccharomyces cerevisiae* quiescence – smart model for toxicological and stress response research" DN11/10, a new smart in vitro model for toxicological studies was developed, including the tracking of a specific set of metabolic, proteomic and genomic markers in quiescent (Go) *S. cerevisiae* cells.

Improvement of the institutional capacity of the cooperating partners was also achieved. It was in the following directions:

- Increasing the scientific and technical capacity of the project participants.
- Acquisition of new knowledge and skills by the young scientists involved in the team.
- Improvement of the material and technical facilities of the laboratory of "Applied microbiology"

Presentation of project "Saccharomyces cerevisiae quiescence – smart model for toxicological and stress response research" at the XIV Congress of microbiologists in Bulgaria with international participation, October 10-13, 2018, Hisarya, Bulgaria

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Mental health and social inequalities

Research area: Social sciences

Research unit: Research Centre for Social Studies, Department of Sociology, Faculty of Philosophy

Funding institution: Bulgarian National Science Fund

Project duration: December 2018 – November 2022

PROJECT COORDINATOR

Ass. Prof. Dr. Veronika Dimitrova,
Research Centre for Social Sciences
at the Department of Sociology,
Faculty of Philosophy

PROJECT OBJECTIVES

This interdisciplinary project originates from links between mental health and social inequalities as identified in a number of countries. The project's main research goal is to establish the link between mental health and social status in Bulgaria and to highlight the sources of stigmatizing attitudes. The project systemises all available data on the links between social status (income and education levels, marital status and children, age) and mental health. Based on this we developed questionnaires for families looking after ill or disabled relatives. We analysed the impact of this type of care on the family's status. In the next phase we will explore public images and attitudes towards mental illness and the responsibility our society bears for mental illness. We will explore images of mental illness presented in the media and, by means of a national representative survey, we will analyse their impact on public attitudes towards deinstitutionalisation.

OUTCOMES

A systematic secondary analysis of existing data for Bulgaria was carried out.

A database of interviews with patients and their relatives was accumulated in order to identify the stigma, the social status, the imprint on the biographical path and the experience.

Media images were analysed (see issue 53 of Critique and Humanism Journal).

The attitudes of Bulgarian society towards people with mental disorders were analysed. The data was presented in a series of publications.

An international conference "Social aspects of mental health and mental disorders" and a round table with stakeholders were held.

One issue of the magazine was published – no. 53 of Critique and Humanism magazine, as well as a collection of reports from the conference held on the project.

The published journal on the topic of the project

APPLICATION AREAS

Sociology of stigma, reform in the area of mental health.

PROJECT BENEFITS

Research has been carried out, which is not sufficiently covered in the Bulgarian literature on the subject. The analysis can serve to change policies in the field of mental health and carry out reform in this area.

The published collection on the topic of the project

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Study of SARS-COV-2 depending on key critical factors in the water cycle of the city of Sofia (COV-WATER)

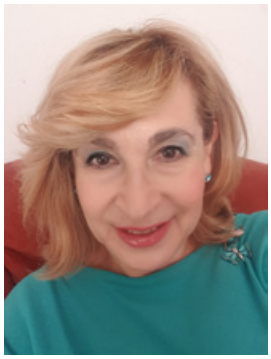
Research area: Biological Sciences

Research unit: Centre of Competence "Clean technologies for a sustainable environment – water, waste, energy for a circular economy", Faculty of Biology

Funding institution: Sofiyska Voda AD, part of Veolia

Project duration: April 2021 – October 2021

PROJECT COORDINATOR



Prof. Dr. Yana Topalova,
Centre of Competence "Clean technologies for a sustainable environment – water, waste, energy for a circular economy", Faculty of Biology

PARTNERS

Laboratory Testing Complex, Sofiyska Voda AD, part of Veolia

PROJECT OBJECTIVES

The diagnosis and tracking of the content of the SARS-CoV-2 virus in the sewage water of the city of Sofia, as well as in other large cities of Bulgaria and the world, makes it possible to predict the spread of the virus – 14 days before its maximum spread. These studies are important for the management of local and regional epidemics and provide a saving of many resources – medicinal preparations, disinfectants, suspension of work of important enterprises, etc. interrelated problems with an impact on human health, the economy and processes related to environmental protection.

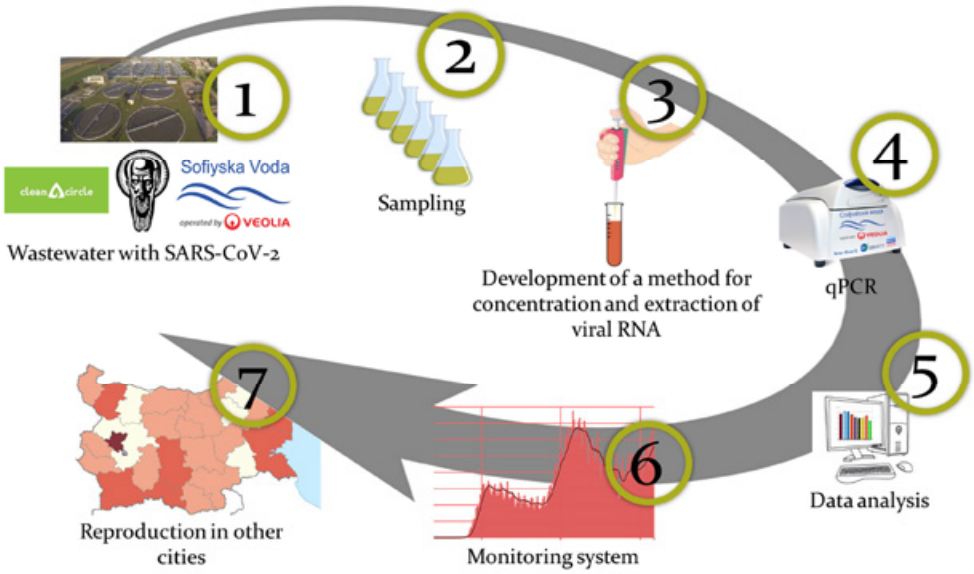
The aim of the current project is to select and adapt an approach method for the study of SARS-CoV-2 in the wastewater from the city of Sofia, as this would serve as a basis for the implementation of the first studies of the virus in the sewage water of the capital. The creation of such a method is of particular importance, since there is a large spectrum of chemical pollutants in wastewater that interfere with the application of the classical method for virus identification.

OUTCOMES

- Four methods for the concentration and extraction of SARS-CoV-2 RNA from domestic wastewater were studied
- Five protocols for the detection of SARS-CoV-2 using different sample preparation methods have been prepared. Various modifications have been made to the sample preparation in the detection of SARS-CoV-2. The concentration and extraction efficiency (1%-6%) is highest in the ultrafiltration variant
- An additional modification was applied based on direct extraction in columns with silica membranes with efficiency above 67%
- An optimal sample pre-treatment protocol was constructed based on high efficiency, optimal time to perform the analysis, cost and reproducibility of results. An optimal RT-qPCR protocol was developed, which was tested in the "Kubratovo" WWTP, and training was conducted for the employees of the "Sofiyska Voda" LIC

The obtained results are published in: *Mihaela Belouhova, Slavil Peykov, Vesela Stefanova and Yana Topalova (2023) WATER 15(4), DOI:10.3390/W15040658, Q1*

Development of a **MONITORING STRATEGY** for early diagnosis of **coronavirus epidemics** with opportunities for multiplication in other Bulgarian cities.



Project BG05M2OP001-1.002-0019: „Clean technologies for sustainable environment – water, waste, energy for circular economy"
www.eufunds.bg

Working hypothesis of the project

APPLICATION AREAS

Epidemiology, control and management of Covid epidemics, without closure of large population centres with a forecast for the application of targeted measures in targeted areas.

This enables large resource savings as well as efficient management of water treatment processes with fewer antibiotics and pharmaceuticals.

PROJECT BENEFITS

The project benefits are in the areas of: epidemiology, protection of human health, protection of the environment from the entry of toxic pollutants into the waste water – disinfectants, antibiotics, chemical therapeutic preparations.

These benefits are also associated with saving resources, including energy, resources for water purification, for the production of therapeutic preparations, protective agents, etc. similar to those used in risky epidemics with large-scale social, ecological and economic effects.

Adaptations to the method are the basis for creating similar epidemiological indicator tools for other viral infections with a high and complex effect on the lives of people and the planet.

Chief Assistant Dr. Mihaela Belukhova – main creator of the innovation protocol

The team, with the participation of Dr. Slavil Peykov, works according to the innovative protocol

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