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## NATIONAL REFERENCE CENTRE FOR GENOMICS AND PROTEOMICS — MACPROGEN

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### INTRODUCTION

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The “National Reference Centre for Genomics and Proteomics” (MACPROGEN) was financed by the European Commission within the FP7 Capacities Work Program for a period of 3 years, starting April 1 2009. The MACPROGEN project aimed at upgrading and improving the capacity of the Research Centre for Genetic Engineering and Biotechnology (RCGEB) “Georgi D. Efremov,” Macedonian Academy of Sciences and Arts (MASA), Skopje, Republic of Macedonia, for research and education in the fields of genomics and proteomics. The main objectives of the project were to establish a technological platform for high throughput genomics and proteomics research, networking with European Union (EU) research institutions in order to foster collaborative activities, disseminating knowledge and expertise and ultimately building an interactive and competitive research environment. Altogether, the realization of MACPROGEN objectives was contributing to the strengthening of Macedonian research, technology and development capacities and enhancing career opportunities for Macedonian scientists.

The RCGEB is one of the few institutions from the Republic of Macedonia that met the criteria for a center of excellence due to its esteemed scientific and educational record in life sciences. The RCGEB was founded in 1987 as a research unit of

MASA with the main goal of advancing scientific knowledge in the field of protein chemistry, molecular biology, genetic engineering and biotechnology through research, practical training of scientists and postgraduate studies. Under the guidance of the late Academician Georgi D. Efremov, the founder and Director of RCGEB until his death in May 2011, the RCGEB became a hub for research in the field of biomolecular sciences in the Republic of Macedonia. It was one of the first institutions in the region that applied these new technologies in molecular diagnostics of human diseases and became an international center for training in basic and advanced methods in these sciences. Immediately after his death, the Presidency of MASA renamed the center in his honor, as the Research Centre for Genetic Engineering and Biotechnology “Georgi D. Efremov.” In the past 25 years, the RCGEB scientists have published over 150 papers in international and national journals, as well as several chapters in books and monographs. The RCGEB collaborates with numerous institutions from the Republic of Macedonia, medical institutions from neighboring countries and many academic institutions from different countries worldwide.

The main research interest at the RCGEB during the past 25 years has been molecular characterization of the most common monogenic diseases, with a special emphasis on hemoglobinopathies, as well as some aspects of the molecular epidemiology of

infectious diseases, genetics of the most common malignancies and DNA markers for human identification. The upgrading of the RCGEB infrastructure by MACPROGEN funds has enabled widening of the research objectives toward larger scale investigations of monogenic diseases and also shifting our research interest toward comprehensive studies of some common complex diseases such as cancers, infertility, mental retardation and deafness by high throughput genomic and proteomic technologies.

**Keywords:** Genomics, Proteomics, Republic of Macedonia

## MACPROGEN PROJECT ACTIVITIES

The activities within the MACPROGEN project were organized into *five work packages*: Management and Coordination (WP1), Technological Platform and Employment (WP2), Networking and Training (WP3), Workshops and Symposia (WP4) and Promotion and Dissemination (WP5).

**WP1: Management and Coordination** covered administrative, financial and technical management of the project activities. The activities within this project were coordinated by the Steering Committee which was composed of the *Coordinator* of the project and the *Work Package Leaders*. The Steering Committee worked closely with the administration and financial departments of MASA, as well as the RCGEB Scientific Committee. The Steering Committee met regularly each month to enable a smooth operation of all foreseen activities and to fulfill the objectives of the project.

**WP2: Technological Platform and Employment** was headed by the late Academician Georgi D. Efremov (until May 2011) and by Professor Dr. Dijana Plaseska-Karanfilska (since May 2011). The three main objectives of WP2: **1)** purchasing of equipment; **2)** preparation of working protocols and operational use of equipment; and **3)** hiring of scientists, were all successfully completed. The following equipment was purchased: DNA microarray system, 2-D DIGE (two-dimensional differential in gel electrophoresis) system, Genetic Analyzer, real-time polymerase chain reaction (ReTi-PCR) system, Bioanalyzer, spectrophotometers, microcentrifuges and liquid scintillation counter. The equipment has already been integrated into RCGEB

laboratory practices and numerous working protocols have been developed using the new equipment. The upgrading of the RCGEB infrastructure was also supported by the Government of the Republic of Macedonia by purchasing additional equipment: 2-D nano HPLC (high performance liquid chromatography), Accuspot and a matrix-assisted laser desorption/ionization time of flight-time of flight (MALDI TOF-TOF) mass spectrometer.

Nine researchers, paid by MACPROGEN funds, have been employed at RCGEB during the work on this project: Lybomira Chakalova, Ph.D., Svetlana Madzunkova, M.D., M.Sc., Predrag Noveski, M.Sc., Sanja Kiprijanovska, Ivana Maleva, M.Sc., Biljana Atanasovska, Zvezdana Moneva, M.Sc., Slavica Pecioska M.Sc and Ognen Spiroski M.Sc. These researchers have become an integral part of the research potential of RCGEB. The Presidency of MASA in coordination with RCGEB is making efforts to obtain permanent positions paid for by the Government of the Republic of Macedonia for the researchers who were working on the MACPROGEN project. Until this is realized, RCGEB has ensured that funds are available for their salaries for the period after completion of the MACPROGEN project.

**WP3: Networking and Training** was headed by Professor Dr. Dijana Plaseska-Karanfilska. The main objectives of this work package were to: **1)** foster networking and establish close collaboration with leading EU institutions; **2)** transfer of the high throughput genomic and proteomic technologies and scientific knowledge; and **3)** foster preparation of collaborative projects.

Six leading EU institutions were our partners since the beginning of the project: **1)** University of Copenhagen, Wilhelm Johannsen Centre for Functional Genome Research, Copenhagen, Denmark; **2)** Hannover Medical School, Gynaecology Research Unit, Hannover, Germany; **3)** University of Barcelona, Faculty of Medicine, Department of Physiological Sciences, Human Genetics Laboratory, Barcelona, Spain; **4)** University of Verona, Department of Mother and Child, Biology and Genetics, Section of Biology and Genetics, Verona, Italy; **5)** University of Copenhagen, Division of Genetics and Bioinformatics, IBHV, Copenhagen, Denmark; and **6)** Institute Paoli Calmettes, Molecular Oncology Department, Oncogenomic Group, Marseille, France.

However, during the work on this project we have established close collaboration with other institutions, namely: **1)** Mondor Institute of Biomedical Research, Henri Mondor Hospital, Créteil, France; **2)** Institut Cochin, Inserm, University Paris Descartes, Paris, France; **3)** K.U. Leuven, Laboratory for Cytogenetics and Genome Research, Department of Human Genetics, Biomedical Sciences Group, Leuven, Belgium; **4)** Vienna University of Technology, Institute of Chemical Technologies and Analytics, Vienna, Austria; **5)** Clinical Proteomics Center, Luxemburg; **6)** Columbia University, Department of Pathology and Cell Biology, New York, NY, USA; **7)** Mabritec AG, Riehen, Switzerland; **8)** University Medical Centre Ljubljana, Department of Obstetrics and Gynecology, Division of Medical Genetics, Ljubljana, Slovenia; **9)** Bulgarian Academy of Sciences, Institute of Experimental Morphology and Anthropology with Museum Sofia, Bulgaria; **10)** University of Glasgow, College of Medical, Veterinary and Life Sciences, BHF Glasgow Cardiovascular Research Centre, Institute of Cardiovascular and Medical Sciences, Glasgow, Scotland, UK; and **11)** Academy of Athens, Biomedical Research Foundation, Biotechnology Division, Athens, Greece.

Knowledge transfer was achieved through the training of MACPROGEN researchers in the new technologies. Several visits of researchers from RCGEB to EU laboratories were organized. These proposed to ensure that RCGEB researchers are familiarized with the new technologies [microarray, 2-D DIGE, mass spectrometry (MS)] through practical experience. Several expert visits were also organized. Some of them were primarily aimed to establish closer professional contacts and facilitate collaboration. In other cases, the main objective was to present and promote MACPROGEN along with the RCGEB. Since the starting date of the project, researchers on the MACPROGEN team have applied for a total of 17 research projects, of which, seven were successful and four are awaiting decisions. Work on funded projects has commenced in accordance with the respective grant agreements.

**WP4: Workshops and Symposia** was headed by Dr. Katarina Davalieva. The objective of WP4 was the organization of three Genomics and Proteomics Workshops and a Final Conference. The

first workshop was organized in November 2010, the second in June 2011 and the third in March 2012. The theoretical part of the workshops included lectures given by scientists from the partnering institutions; the lectures were attended by the members of the Macedonian Biochemical Society and Macedonian Society of Human Genetics. The practical part of all three workshops was mainly attended by RCGEB scientists and collaborators, but on the first workshop 24 scientists from different Macedonian research institutions also participated. The practical part of all three workshops included demonstration of protocols using the major new equipment.

The Final Conference took place at Ohrid, Republic of Macedonia, at the end of March 2012. Ten scientists from 10 different EU institutions participated, in addition to all RCGEB employees and several collaborators from the Republic of Macedonia.

**WP5: Promotion and Dissemination** was headed by Dr. Emilija Sukarova-Stefanovska. The objectives of this work package were to: **1)** promote the activities and potential of the National Reference Centre for Genomics and Proteomics; **2)** increase and strengthen the collaboration with institutions from the country, the wider region and the EU; and **3)** increase the participation of scientists from the Republic of Macedonia in FP7. These objectives have been accomplished as planned. The website of the National Reference Centre for Genomics and Proteomics ([www.manu.edu.mk/macprogen](http://www.manu.edu.mk/macprogen)) was launched during the second month and has been regularly updated to reflect the progress of project activities. Leaflets containing relevant information on MACPROGEN have been published three times and distributed during events, such as meetings, lectures, *etc.* Meetings with clinicians, health professionals and research scientists from several institutions have been periodically organized to discuss the Centre's policies for achieving optimal translation of its potential. During the work on the MACPROGEN project, RCGEB scientists have participated in several scientific meetings and published 36 conference abstracts. The MACPROGEN researchers have also published 25 papers in international and national journals.

**Project Impact.** The introduction of novel genomic and proteomic technologies at RCGEB

“Georgi D. Efremov” has already resulted in strengthening of Macedonian and regional research capacities. Experienced scientists, some of them trained in EU countries, have joined the RCGEB team. Contemporary research projects in collaboration with leading EU institutions have been initiated. It is very much hoped that the modernization

of research along with intensified collaboration will further stimulate promising young scientists to establish their research in the Republic of Macedonia. It is expected that the improved infrastructure and research environment will have long-lasting effects, such as enhanced levels of science communication and high-impact publications.