

*In memoriam*

Academician Marko Anđelković



On April 10th this year our professor, advisor, colleague and friend, Honorary Member of Serbian Genetic Society, Academician Marko Anđelković died in his home in Belgrade, outlived and mourned by his beloved family, his team of closest associates, former students, numerous colleagues and friends. I have been working with him for 38 years, and writing this obituary is a very difficult task. Something I need to do despite being still in denial that I cannot share with him the updates and thoughts of the present work and life generally.

Born in Belgrade, September 18th, 1945, he used to describe his youngest years of life, including education, as „shaped by the heart of Dorćol and Stari grad“. Indeed, he lived and worked in the heart of Belgrade ever since, describing those days often, bringing the spirit of those times closer to all generations. His interest in diversity of life, including consorting with different people, started in high school, but his interest in nature and biology dates back to an influential Biology teacher in elementary school, which resulted in his final year paper „The Life of Bees“. There must have been more than a coincidence that six decades later a part of his team of postdocs and PhD students have been awarded a prestigious grant for studying the conservation aspects of bees.

Academician Marko Anđelković graduated in Biology from the University of Belgrade in 1968, actively sharing events marked by a spirit of student rebellion that swept through countries all over the world. A year before graduation he came across a book on General Genetics in the American Library in Belgrade, and he searched if someone within the University of Belgrade is doing research in that field. He found out that at the end of 1967 Academician Dragoslav Marinković returned from his postdoc specialization in USA, where he worked with the famous Th. Dobzhansky, and subsequently established the first *Drosophila* laboratory in the region and organized the first course on Genetics for undergraduate students, followed by postgraduate studies in Genetics in 1969. As a young graduate student, Anđelković joined Marinković's group and pursued his career in population genetics. Those were the times of enthusiastic diligence in scientific research, as he used to say. In his last interview to „Vreme“ (December 2019) he pointed out that he had never been guided solely toward a reward measured by the degree or quantitative assessment, but by the interests for the challenging research topics and own potentials to realize them.

Since 1969 Marko Anđelković was affiliated with Institute of Biological Research „Siniša Stanković“ (IBISS) and in the same year he spent a few months at the University of Vienna, in a laboratory headed by Prof Diether Sperlich (also one of Th. Dobzhansky's students), studying chromosomal inversion polymorphism of *Drosophila subobscura*, and acquiring new skills from the best in the field of cytogenetics of the species that remained his favourite research model to the end. His PhD thesis was completed at the University of Belgrade in 1978 and the dissertation was the first work that shed light on the genetic background of the light dependent courtship behaviour in *D. subobscura*. In 1979 Dr Marko Anđelković spent one year as a postdoctoral fellow in the laboratory of Prof Jeffrey Powell at Yale University, and the next two decades of his research were focused on functional aspects of gene-enzyme polymorphisms in adaptation to different environmental conditions including stress. He strongly encouraged us to gain the experience in international research ambience, considering it as the best way to verify own achievements and explore personal potentials outside the original environment.

Since 1989 Prof Marko Anđelković shares his commitments between two institutions: Institute of Biological Research „Sinisa Stankovic“ and Univeristiy of Belgrade - Faculty of Biology, and began his teaching career. He mainly taught at the postgraduate level in Genetics, such as Population Genetics and Genotoxicology, adapting the curricula along the developing progress in genetic research. His course in the Population Biology module was much appreciated among students. Last year one of his former students from those generations expressed to him her gratitude for the course, which surprised but much pleased him. By invitation he also taught parts of the courses at Biology Department at the University of Montenegro, Faculty of Medicine and Faculty of Geography at the University of Belgrade. He was known for his written sentences in manuscripts that were exceptional, comprehensive and sometimes hard to translate. On the other hand, his lectures were clear, with intuitively logical explanations of highly complex processes. He never asked students to „know the formulas“ (which dominate population genetics textbooks at the first sight) but insisted on understanding them as relations among variables and parameters of some processes or phenomena. The book „Genes in populations“ that we jointly and enthusiastically begun writing around mid '90s, was finally published in 2014, and remains a valuable contribution to the literature on population genetics that Marko taught as professor. Although retired in 2010, after bringing up 20 generations of students, he remained an active member of the academic community. Frequently regretting the lack of time and, despite his health condition, he continued to contribute both through mentoring in research and teaching PhD courses with insightful comments, questions and advice.

In 1991 Dr Marko Anđelković acquired the title of Principal Researcher, and in 1992 University Professor. In 2003 he became the Corresponding Member of the Serbian Academy of Sciences and Arts (SASA), and since 2009 he was the Full Member of SASA. He chaired the Department of Genetics at IBISS for years, and in 2006, with a group of associates, he established the *Department of genetics of populations and ecogenotoxicology* at IBISS, which he chaired until retirement. The Department has been developing successfully over generations, attracting and accepting new associates.

Dr Marko Anđelković was an inspiring and stimulating person. He was truly a leader and statesman of science, contributing his talents to so many activities in the profession and the community. He was an influential figure in addressing major issues of science and shaping public policy toward them, holding numerous posts in scientific societies, institutional bodies at the University of Belgrade, Serbian Academy of Sciences and Arts, expert bodies within state ministries. He believed that one has an obligation to contribute to the enhancement of the society with one's own knowledge and within capabilities. He served as a member of presidency of several professional organizations and national councils, advisory and review committees, often as chair. Academician Marko Anđelković chaired the Committee for Man and the Environment at SASA, from where he initiated and organized valuable meetings and scientific discussions on the current and the most intriguing issues for the society, such as the Symposium on Genetically Modified Organisms, and the Symposium on the Effect of Small Hydroelectric Plants on the Environment in Serbia.

He was awarded the City of Belgrade October Award for Science and the Serbian Biological Society Award for development of Biological Sciences.

Though constantly busy, his door was always open, and he was never too busy to talk to anyone. A gentleman and scholar of the highest order, charming and social, urbane and witty, Marko Anđelković was also known for his ability to lead diverse people toward cooperation. Usually he would ease the staff meeting, or serious discussion that begins with tension, with humorous anecdotes and historical asides, but without minimizing the importance of meeting the goals.

Academician Marko Anđelković published 160 scientific papers and some are still to be published as research has been done with his contribution and support. A larger group of papers pertains to ecological-genetic adaptations of genetic polymorphism, through research into inversion polymorphism of chromosomes, genetic loads, gene-enzyme polymorphism in some *Drosophila* species, and the last two decades also research at the level of DNA polymorphism. The results give insight into the spatial and temporal variation and adaptive significance of genetic polymorphism of natural populations, as well as relative impacts of individual evolutionary factors, especially selection mechanisms, on the process of adaptation and dynamics of population gene pools, as changes included into the general or specific responses to environmental stress. Part of his research was the assessment of mutagenic (and antimutagenic) effects of different substances in research aimed at revealing biological effects of environmental pollution. The results are valuable from the aspect of conservation of biodiversity and detection of dynamics of causal changes in gene pools of populations exposed to antropogenic influence in the natural environment.

My account on research in population genetics and with fruit flies begins in the winter of 1981/82 when I had an interview for a position of research assistant at IBISS, in the group of Dr Marko Anđelković. Freshly graduated

in the field of microbiology I was rather reluctant to change to population genetics and an insect as a research model. However, working with fruit flies and in the laboratory atmosphere headed by Marko's inventive authority, accompanied by his unique witty remarks, easily became part of my life. He always found pleasure and satisfaction in working with flies. Due to many commitments over the years, he was less involved in experimental work, but he was pleased to help. We keep his box with necessities for handling the flies. During spring of 2019 we were working on large phenotyping experiments within the DrosEU consortium project, and Marko took an active part in scheduled fly counting and monitoring. But, work for him has always been accompanied by other aspects of life. And he had many interests. He used to say that life is a mosaic of diverse interests and aspects, not just science, that should all fill our lives with contentment.

His favourite and maybe the most important part of research was field study, since „biological processes unfold in the natural environment“. Numerous projects he led over the years were conceptually framed to combine experimental and field research, as reflected in the recent one - „Ecological and genetic studies of *Drosophila* populations from the Central Balkans“. He participated in and/or organized about 70 field trips in his career, including several abroad. Those were true „summer schools“, with both field work and seminars/discussions that we all enjoyed. He used to say that a field trip is the best way people and associates get to know each other and learn about the research they do. He recognised from the beginning the need for an extracurricular education scientific center for high-achieving students, as a resource for future science education, thus, he was a supporter, and for many years president, of the scientific board of the SC Petnica.

Professor Marko Anđelković was a renowned researcher, teacher, a dedicated advisor and mentor to numerous graduate students and postdoctoral fellows, many of whom went on to establish successful careers of their own. Part of his legacy is his research group, organized on the principles of bringing smart diligent people together to pursue their passions for biology, encouraging interaction, team work, loyalty and mutual respect, and the free sharing of ideas and resources. He was proud to see that his young associates became recognized among international scientific communities which reflected the best in organizing the Population genetics Symposium in Belgrade 2012, with eminent speakers from abroad, and to see his group as an active member of the European *Drosophila* Population Genomic Consortium since 2016. Marko Anđelković recognized and taught us the importance of the population genetic aspect in conservation biology. Although he has been working with *Drosophila* since ever, he emphasized the importance of making research projects towards phenomena, and not the object (species) itself. Just a few months before his death he was pleased to see the achievements of members of his „*Drosophila*“ team who also pursued a population genetics study of the Griffon vulture in Serbia, and a conservation genetics project on honey bees. Last year, Marko Anđelković was awarded a strategic grant by the Serbian Academy of Sciences and Arts, for the project that sums up the main focus of his research in both population genetics and ecogenotoxicology. The project integrates methods of experimental evolution, ecological and molecular genetics and genomics, in evaluation of the effects of anthropogenically elevated concentrations of heavy metals on the genetic structure and adaptation of populations. He had slowed down physically over the last couple of months but just a few days before he passed away we spoke about project activities and the consequences of the current lockdown situation due to pandemia and other obstacles.

To honor Academician Marko Anđelković on the occasion of his 70th birthday, a collection of scientific papers was published in September 2015 titled „Diversity in Origin and Persistence“. The monograph includes 13 review papers on population, ecological genetics and ecogenotoxicology, the fields in which he gave not just his contribution in our scientific environment, but also a founding framework for two of them. The authors are reputed researchers, who have been his immediate coworkers – part of his team, or have worked with him in some periods of scientific and/or teaching career. Most of the authors were also his PhD students to whom he contributed in their professional upbringing. The title of the monograph reflects the core of Marko's motto in the professional life: to respect and cherish diversity and endurance in collaboration. Although different personalities, separated by generations, within the four decades spanning across two centuries in our scientific careers that developed in shades of diversity of our research areas, we persist by carrying common episodes of good science and teaching shared with Academician Marko Anđelković.

This actually sums up the description of everybody's life which is entangled with Marko's – including mine.

Marina Stamenković-Radak