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**IN MEMORIAM**

# PROFESSOR ZVONIMIR M. DAMJANOVIĆ (1929 - 2004)

UDC 929 Damjanović Z. : 59

Professor Dr. Zvonimir Damjanović passed away after a short illness on December 31, 2004. He was a full professor in the Department of Biology of the Faculty of Science (now the Faculty of Biology) and the Center for Multidisciplinary Studies (CMS) of Belgrade University, as well as a regular member of the Montenegrin Academy of Sciences and Arts. He belonged to the generation that took part in the Second World War and invested all his youthful elan and enthusiasm in the reconstructed university. To the end of his life, he remained as devoted as ever to research and science and gathered around himself friends and associates of different profiles and ages. As communicative and open as he was, he had in various settings a large number of friends, associates, and students, who were deeply saddened by his death.

Zvonko Damjanović was born in Šavnik, where he spent most of his early childhood. Growing up in the family of a physician who served in different places in Serbia and Montenegro, Zvonko completed elementary school and the first two years of high school in Kalna, Babušnica, and Nova Varoš, where the outbreak of the war found him. After he and his mother were driven out of Nova Varoš, they lived in Pljevlja and its vicinity until April of 1943, when they joined the People's Liberation Army, in which his father served from the first day of the uprising. Upon the liberation of Belgrade, he moved to that city, where he performed various duties in youth organizations until August of 1947. At the same time, he attended high school to grade 7 in a school for pupil-soldiers, after which he completed grade 8 with his generation and graduated as a regular pupil from the Third Belgrade High School for Boys in 1947. In the same year, he went as a scholarship recipient to Moscow, where he enrolled in the biology program of the Lomonosov Moscow State University. He completed only the first year there, then continued his studies in the biology program of Belgrade University's Science Faculty. He nevertheless acquired a solid fund of knowledge that year and in Belgrade soon distinguished himself as an excellent student. All his life he remained an admirer of Russian culture and art and in his leisure hours gladly quoted and recited the verses of Pushkin and other writers.

Zvonko Damjanović graduated in biology from the Science Faculty in February of 1951, with botany as his major subject. As an excellent student, he was appointed to the position of Assistant at the Botanical Institute. From the outset, he opted for plant physiology and took part in the organization of lab sessions in that subject. In 1952 he received a scholarship for post-graduate studies in London. He spent not quite two full years (1952/53) in the Botany Department, Royal College of Science, where he investigated photosynthesis in stomata guard cells under the supervision of Professor Gregory. He was forced by illness to discontinue that work and return to Belgrade. In 1955/56 he made further use of his scholarship for study at the Institute of Plant Physiology, University of Göttingen, under Prof. E. G. Pringsheim. There he performed the experimental part of his doctoral dissertation, which he completed in Belgrade under the supervision of Prof. Dr. Ljubiša Glišić. He defended his doctoral dissertation (entitled "Investigation of Chemotaxis in Flagellates") in May of 1958 and the same year was appointed to the position of Assistant Professor for Plant Physiology in the Department of Botany. He was the University of Belgrade's youngest assistant professor at that time. During four years he performed the functions of Vice-Chairman of the Federal Committee for Coordination of Scientific Work with the rank of Federal Under-Secretary. He relinquished those duties to become Director of the University of Belgrade's newly founded Center for Multidisciplinary Studies. In 1979 he was appointed to the position of Associate Professor and in

1984 named Full Professor for the subject "Cybernetics of Biological Systems" within the CMS. Until his retirement, he taught this subject to students of the CMS, postgraduate students from different programs of the Faculty of Biology and students from certain programs of the Faculty of Mathematics. His textbook (monograph) "Principles of Biocybernetics" today remains our only textbook in this area. In 1985 he was elected an associate member of the Montenegrin Academy of Sciences and Arts, of which he became a regular member in 1993.

As a prominent scientific worker with clear awareness of the state of science in our country and a visionary view of the future, Zvonko Damjanović in the course of his working life was appointed to perform various functions in scientific, social, and political organizations. To mention only the most important of them: he served as Delegate to the Socialist Republic of Serbia's Parliament (1962-1964); Member of the Central Committee and Member of the Presidency of the Central Committee of the Serbian League of Communists; Vice-Chairman of the Federal Committee for Coordination of Scientific Work (1968-1972); Member of the Board of Education of the Socialist Republic of Serbia; Chairman of the Council of the Institute for teaching books and teaching aids; Chairman of the Assembly of the University of Belgrade and Chairman of that body's Commission for International Relations; and Member of the Commission for Higher Education in the Parliament of the Socialist Republic of Montenegro. He also performed the duties of President of the Serbian Biological Society and Chairman of the Yugoslav Biophysical Society, in addition to which he was a member of the editorial boards of the journals "Archives of Biological Sciences" and "Dialectics."

All of the functions that Zvonko Damjanović performed outside of teaching were tied up with his main activity as a university professor in keeping with his conviction that it is possible to contribute most to organization of the instructional and scientific process from various positions of influence. His start in science coincided with very significant achievements in biology, with firm linking of formerly disjunct natural sciences and mathematics, and with the emergence of new interdisciplinary areas. He was well aware of those new tendencies and of the need to reform scientific work at the university level and the process of education of students in accordance with them. However, he was conscious of the fact that a completely new institutional and organizational base would be needed for this. Damjanović was part of a small group of colleagues headed by Prof. Siniša Stanković who united two up to then independent institutes of the Serbian Academy of Sciences and Arts (the Institute of Ecology and Institute of Genetics), with new organizational units composed of specialists from several faculties concerned with fundamental biology. The Siniša Stanković Institute of Biological Research (SSIBR) was formed in this way with the basic idea of closely linking the university with a scientific institution for the purpose of better programatic, personnel, and financial organization. In this institute, Damjanović supervised the Laboratory of Plant Physiology and later the Department of Biocybernetics. The SSIBR soon founded divisions that developed into the Institute of Marine Biology in Kotor and the Biological Institute in Titograd. But Damjanović's ideas about the interdependence of science and teaching were best expressed in organization of the Center for Multidisciplinary Studies, which was founded at his initiative and according to his ideas. Teaching in the CMS was modular and organized in such a way that students freely combined subjects within the framework of the specialities they selected, the lecturers being prominent experts from several faculties, a basic principle advocated many years later by universities within the European Community. All of these organizations justified their existence, a fact that is best illustrated by the number and quality of students who earned master's and doctoral diplomas from them. Damjanović's teaching activity was not solely confined to our country. In 1989 he organized the UNESCO Summer School in Kotor, with about 50 students from 15 developing countries. UNESCO incorporated the program for work in their program and adopted the proposal that the Institute of Marine Biology become a permanent base for teaching and application of new technologies in the educational systems of a series of countries.

Although Zvonko Damjanović was in basic orientation a plant physiologist, his scientific approach to the problems he dealt with was for our milieu completely unique and original. Possessing a good knowledge of the essentials of general cybernetics, he strove to apply cybernetic principles of communication and control to living systems. From the results of biological experiments, he attempted to construct mathematical models that ignored many detailed properties of objects, but which accurately represented a system of stated values. That system essentially behaves like the object as a whole and is subject to investigation through simulation by ex-

periments otherwise unperformable in nature. Damjanović based his main procedural approach on an original model, namely the "biochemical gray box model," with which it is possible to model biochemical cyclical systems; from that there evolved the "reiterated box model" and the "model with pure delay" which are applicable to a broad class of experiments in biophysics and neurosciences. Zvonko Damjanović had the gift of quickly mastering the essence of other sciences and he established excellent cooperation with a group of eminent mathematicians. For their part, they acknowledged themselves confronted with a series of mathematical and numerical problems leading to original contributions in biomathematics and biocybernetics. The resolution of these problems called for broad international cooperation.

In view of the enormous diversity of biological objects and phenomena, Zvonko Damjanović concentrated his attention on general biological phenomena such as irritability and adaptability, which is to say on the universal ability of living beings to receive signals from the environment and alter their behavior in keeping with them. His studies were performed on various objects, from flagellates (phototaxy), lower fungi (formation of the conidial apparatus), and organs of higher plants (growth, electrophysiology, ion transport on biomembranes) to different groups of mammals (information transfer in the cerebrum). Damjanović was intensively concerned with structure of the genetic code, and he proposed a model that perhaps might explain establishment of the code at the time of prebiotic organic evolution. In experiments with plants and fungi, he tested the response to light and darkness and especially examined the effect of intermittent light, which made possible certain interesting conclusions about the action of light as a control factor. The greatest achievements of Damjanović's group were probably in the area of neurophysiology, in which he established rich and intensive cooperation with a number of relevant institutions in the world. Already in 1968 he initiated work on the project "Mechanisms of Multichannel Information Transfer in Sensory Systems of the Cerebrum," on which the CMS (supervised by Damjanović) collaborated with the Laboratory of Neurocybernetics of the Brain Institute, Academy of Medical Sciences of the USSR (supervised by N. N. Lyubimov). Within the framework of the project (up to 1996), research was carried out on structuro-functional organization of projections in certain afferent channels of the visual and somatosensory system, as well as on mechanisms of rehabilitation of disturbed nervous functions after deafferentation in visual and somatosensory centers of the brain stem in primates and other mammals. Also investigated were mechanisms of conditioned reflex establishment under conditions of a somatosensory deficit. The obtained data were analyzed on computers using program packages developed by the Biocybernetics Group of the CMS. Workers in the Brain Institute's Laboratory of Neurocybernetics constructed a "kinesthetic mechanical stimulator," a new device for examination of the kinesthetic analyzer in the norm and pathology. An improved version of this device with electronic control was produced at the Department of Electrical Engineering of the University of Chelyabinsk in 1991. The device was patented and introduced in clinical practice at the Irkutsk Psychiatric Hospital, where it is used to obtain early diagnosis of kinesthetic sensitivity, evaluate the degree of disturbance of the kinesthetic analyzer, and predict the dynamics of a number of neurological diseases. For fruitful scientific collaboration, Damjanović on his 60th birthday received a citation from the Academy of Medical Sciences' Brain Institute.

Zvonko Damjanović was the initiator and carrier of the Anglo-Yugoslav Link program, which with the support of the British Council was established in cooperation with the CMS and Chelsea College of London University. Initiated in 1978 under the title of "The Computer and Learning," this decades-long program gathered a multidisciplinary group of investigators and encompassed the organization of a series of workshops in Britain and Yugoslavia alternately, as well as exchange of a large number of researchers. A significant number of scientific studies were carried out and monographs were written that resulted in the creation of several mathematical models of complex living systems and development of simulating computer programs. In connection with elaboration of the indicated models, many mathematical problems naturally emerged that were resolved using mathematical and numerical approaches.

The grave events of the 1990's made impossible certain especially interesting initiatives in cooperation of our scientific institutions with foreign institutions working in the framework of the European Community.This was the case with establishment of relations between the Montenegrin Academy of Sciences and Arts and the Eduardo R. Caianiello International Institute for Advanced Scientific Studies (IIASS) in Salerno, Italy. Zvonko Damjanović was several times a guest of that

institute, the last time in 1995, when he delivered a lecture at Workshop VII on Neural Nets. He was chosen to represent the IIASS in the area of neurobiology and ecophysiology in negotiations on expansion of the system to Russia and other countries of Eastern Europe. And this case shows how highly regarded Damjanović was in world scientific circles as a scientist and promoter of international cooperation. It can only be regretted that he never completed the book in which he intended to summarize his results and those of associates whose work he supervised.

For what will Zvonko Damjanović be best remembered by those who knew him? There are many answers to this question. His colleagues will remember him for his broad knowledge of biology and related sciences; for the ease with which he grasped new scientific problems; for his propensity and capacity for abstract thought and theoretical considerations; and lastly for the eloquence with which he presented and defended his views. His associates will remember him for the creative working atmosphere he created around himself. Younger associates and students will remember him for the enthusiasm that he conferred on his surroundings and which persuaded them to choose an area of interest to him. His close friends, finally, will not forget his graciousness, openness, good nature, and the sympathy he was able to show in certain difficult moments. With his work and personal qualities, Zvonko Damjanović was one of the most striking personalities in biological circles and the scientific community as a whole, which will long feel an emptiness as a result of his passing.

Prof. Dr. Mirjana Nešković