

**A ROMANIAN BIOPHYSICS RESEARCH SCHOOL FOUNDED
BY PROFESSOR PETRE T. FRANGOPOL**

Biophysics is an interdisciplinary field in which methods from physics, biology, chemistry and computational sciences are being used to understand phenomena at the interface between biology, chemistry and physics. For example, one may want to understand how local anesthesia works, where do the local anesthetics go, what is their interaction partner in the biological cell, and how the effect of anesthesia is brought about. Or, one may ask the question: what happens, at the atomic/nanoscale level of detail in the brain affected by Alzheimer's disease?

In this article, generously hosted by the *Romanian Journal of Biophysics*, we present a brief account of the personal contributions to the Romanian biophysics brought by Prof. Petre T. Frangopol (P.T.F.) who recently celebrated his 80th Birthday. Prof. Frangopol was born on the 26th of May 1933 in Constanța, on the shores of the Black Sea which is so full of antique remains. He attended the primary school in his native town (1940–1944), the cosmopolitan and colorful port of Constanța, and then what is known nowadays as the National College “Mircea cel Bătrân” (1944–1951). According to a family tradition he became a student at the Faculty of Industrial Chemistry at Polytechnical University of Iași (1951–1956). He graduated with a thesis entitled *Coloranți cu sulf (Dyes with sulphur)* under the scientific guidance of Associate Professor Gheorghe Lupușor. P.T.F. is the third chemist in Frangopol family after Dumitru Frangopol, with a doctorate degree at Polytechnical School of München (1910) who became the first chief of the Chemistry laboratory of the Constanța harbor and I. Frangopol who worked as an engineer in oil industry between the World Wars at Ploiești (and his scientific papers were cited by professor Negoiță Dănilă, the founder of the industrial chemistry higher education in Romania). Iași was a totally new world for the young student (P.T.F.) who gained, not only the basic scientific instruction, but also the scientific cultural spirit of the time. This will become evident later in his multitude of fields of interest.

After graduation he was employed by the Institute of Petrochemistry in Ploiești and after several months by the newly created Institute of Atomic Physics (Institutul de Fizică Atomică – I.F.A.) in Bucharest-Măgurele, where he attended a special course in Physics and Nuclear Technology (1956–1957). He was subsequently employed in the Chemistry Lab of the Cyclotron Division. So, it starts the long road of the professional life which continues today. Now, at his 80th

Received July 2013;
in final form December 2013.

anniversary, P.T.F. has published a number of 99 I.S.I. articles and has a Hirsch index (h) of 13, apart from numerous other articles and books in the field of biophysics, biophysical chemistry, chemistry, archaeometry, science policy, scientometrics and many commemorative articles dedicated to famous Romanian scientists.

P.T.F. started his career as a chemist. His doctorate was supervised by Professor Giorgio Ostrogovich at Polytechnical School of Timișoara. The original results of Frangopol's studies described in his PhD thesis: "Stable free radicals of the diarylnitrogen class" have been published in the prestigious journal *Tetrahedron*. Then P.T.F. performed research in postdoctoral stages in Canada (1969–1970) at the National Research Council, Canada Division of Chemistry, Ottawa (there were 300 candidates from all over the world and only ten selected). This was followed by a Humboldt Dozentenstipendium, Germany (1972), with a project submitted from abroad. In the meanwhile, he was a postdoctoral associate (1971–1972) at George Washington University, Washington D.C. with a project financed by NASA.

Some of the compounds which were characterized at the beginning of his career have been subsequently utilized as spin markers in the biophysical chemistry investigation by N.M. Connel in the USA and A. Rassat in France. In Romania, the use of nitroxide free radicals as spin markers was introduced by one of us in the years 1970 (G.B.). The research concerning the use of spin markers in biophysics was done in close collaboration between the labs of G.B. and P.T.F. Following various stages of work in the USA, Canada and Germany P.T.F. became the head of the organic labeled compounds at the Institute of Atomic Physics. Here P.T.F. and dr. Maria Frangopol established the protocols for the synthesis of the radio isotopes Ga⁶⁷, In¹¹¹, I¹³¹ and also synthesized the spin labels used in the late 1970^s and 1980^s for the research on biological membranes that was pursued in the G.B. lab at "Iuliu Hațieganu" University of Medicine and Pharmacy in Cluj-Napoca. The fruitful collaboration between the laboratories led by G.B. and Frangopol relied in part on tools produced at I.F.A., such as the RES ART-6 spectrometer. G.B. and Frangopol have written extensive reviews regarding the use of spin labels (and the ART-6 spectrometer) to help other scientists (from Romania or from abroad) to use these techniques. In addition P.T.F. obtained financial aid as grants from Academy of Medical Sciences and Industrial Pharmaceutics and educated younger scientists (including G.B.) in the "art" of writing research grant proposals. An important achievement (very rare in the period before 1990) was the fruitful cooperation between G.B., P.T.F. and Professor F. Kummerow and Dr. R. Holmes (University of Illinois, Urbana-Champaign, USA). Joint publications of the Romanian and American scientists on basic biophysical research with medical implications have been accomplished. It should be emphasized that the synthesis of spin labels and their use in studies on protein-lipid interactions of the effects of drugs on biomembranes was the beginning of the implication of Frangopol in biophysical research and also in multidisciplinary research.

One of the most important directions of research was the biophysical chemistry of Romanian drugs (Gerovital, Aslavital, Boicil), a project which extended for several years in cooperation with Vasile V. Morariu and other

research groups in Bucharest and Cluj-Napoca. This work was jointly granted (P.T.F. and V.V.M.) the Romanian Academy Award in 1986.

As a natural continuation of his work on using spin labels to characterize protein and lipid interactions, in 1990 Frangopol accepted the invitation from Professors Mircea Sanduloviciu and Gheorghe Popa to establish a Biophysics and Medical Physics Laboratory at the “Alexandru Ioan Cuza” University of Iași, Romania. Frangopol’s first office at the University of Iași consisted of a desk, a chair, and a hallstand that he could use while train commuting over 500 km from Bucharest. The first equipment for the lab came from the Physics Department of the University, from donations from Switzerland and from the Institute of Atomic Physics in Bucharest, and from small funding obtained from the Ministry of Education to buy desktop computers and small consumables. A first breakthrough came when Frangopol obtained a grant from I.A.E.A. (International Atomic Energy Agency) from Vienna; this award helped to establish the medical physics lab at the Physics Department. Importantly, the lab staff included student assistants recruited from among the best students of the Physics Department.

Soon after acquiring funding from the I.A.E.A., Frangopol was successful in obtaining grants from Copernicus, Tempus, and the Soros Foundation. The additional funding made it possible to equip what was to become the second Biophysics and Chemical Biophysics lab at a Romanian University (the first lab had been established earlier at the University of Bucharest). The research focus for the Biophysics portfolio of the lab was using experimental biophysics techniques to understand how local anesthetics interact with lipid bilayers, and the usage of lipid bilayers as biosensors. For Medical Physics, the research focus of the lab was that of dynamical nonlinear systems, for their potential of applications in heart health.

For today’s young researcher, accustomed to a wealth of books in the libraries, bookstores, and the internet, the scarcity of up-to-date biophysics and medical physics books in the Iași of mid 1990s may be difficult to envision. To bring the literature up to date, Frangopol and the Iași biophysics lab used funding from the international grants to publish a series of six volumes “Current Topics in Biophysics” containing reviews by experts in various fields of Biophysics. These books were valuable resources for students studying for their research projects. Several students, trained in Iași under Frangopol guidance, including Ana-Nicoleta Bondar, became biophysicists working in Romania, Germany or USA.

P.T.F.’s contributions to Romanian biophysics are not restricted to I.F.A. or to the University of Iași. In 1999 he moved as visiting professor to the “Babeș-Bolyai” University of Cluj-Napoca, where he collaborated closely with Professor Maria Tomoaia Cotișel. There, he obtained a substantial C.N.C.S.I.S. grant that made it possible to acquire an Atomic Force Microscope that was used for biophysical research). Together with Maria Tomoaia Cotișel, Frangopol introduced the technique for Langmuir-Blodgett (L.B.T.) thin layers at the University of Cluj.

Among the many fields of interest for P.T.F. was archaeometry that is the application of the scientific techniques in the investigation of archaeological

artifacts. He published in English with V.V.M. the first two volumes *Archaeometry in Romania* and he was permanently a supporter of this activity in Romania.

After having retired from putting together labs, introducing new directions of research, and training students and collaborators, Frangopol remained a strong supporter of Biophysics in Romania. It should be mentioned his work in the field of science policy and scientometrics. He is Editor in Chief of the journal *Revista de Politica Stiinței și Scientometrie (Journal of Science Policy and Scientometry)*. A particular effort was dedicated by P.T.F. to promote excellence in the scientific research in Romania. He published many books on this subject as well as in the field of science policy and scientometrics. Last but not least he published articles commemorating representative personalities of the Romanian physics and chemistry.

P.T.F. was invited to give lectures and seminars at many famous laboratories in Europe (C.E.N. – Grenoble, C.E.N. – Saclay, Leuven University, Manchester University, Marburg / Lahn University), U.S.A. (Oak Ridge National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory), Japan (Kagawa Medical University), as well as international conferences of the domains in which P.T.F. performed research, including the well-known ones with a limited number of participants (Gordon Conferences, EuChem Conferences, etc.).

His contributions in various fields of science including chemistry, biophysics, archaeometry and science policy were honored with the title of Honorary Member of the Romanian Academy.

We may conclude with a thoughtful characterization made by Academician Ionel Haiduc (President of the Romanian Academy): “Petre T. Frangopol distinguished himself as a personality of great originality, perhaps unique, in the present “landscape” of the Romanian science. Owing to his scientific erudition, he succeeded not only to orient the research laboratories that he founded towards modern directions in science, but he has also coherently chosen multidisciplinary themes from the domains of chemistry, radiochemistry, physics and biology”.

Acknowledgments. The authors are very grateful to Prof. Ana-Nicoleta Bondar (Theoretical Molecular Biophysics, Department of Physics, Freie Universitaet Berlin, Arnimallee 14, D-14195 Berlin, Germany) who agreed to insert in this article some thoughtful remarks that she has written regarding the contributions of Prof. Petre T. Frangopol and the development of biophysics in Romania.

VASILE V. MORARIU

National Institute for Research and Development for Isotopic and Molecular Technology,
Cluj-Napoca, 65–103, Donath st, 400293 Cluj-Napoca, Romania;
Academy of Romanian Scientists, E-mail: clujnapocaclujnapoca@yahoo.com

GHEORGHE BENGA

First Laboratory of Genetic Explorations, Cluj County, Clinical Emergency Hospital, 6, Pasteur St.,
4003249 Cluj-Napoca, Romania; Department of Cell and Molecular Biology, “Vasile Goldiș”
Western University Arad, 94–96, Revoluției blvd, 310025 Arad, Romania