

PETRE T. FRANGOPOL (1933-2020). ROMANIAN ACADEMIC, SCIENTIST, MENTOR AND FRIEND

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In December 2020, academics and scientists – particularly chemists – received the very sad news that our beloved colleague and friend Petre T. Frangopol passed away. The aim of this obituary is to pay tribute to an outstanding Romanian scientist, a man of great character and an unforgettable friend. Petre T. Frangopol (a.k.a. Petrache for his friends) described in detail the history of his family in a Meeting of the Romanian Academy (October 8, 2018) dedicated to his 85th anniversary. I had the honor to be invited speaker to that event, as we collaborated for several decades. The proceedings of that Meeting were published [1, 2].

Petre T. Frangopol was very proud of the *saga* of his family. His great-grandparents were Greeks from a village in Bulgaria called Mesemvria (Nesebăr of today), where the Greeks (mainly shepherds) formed 100% of the population. After an ethnic cleansing done by the Bulgarians in 1860, all the inhabitants of this village sold their properties and came to the historical region of Romania called Dobruja (Dobrogea), on the Black Sea Coast, namely to Kiustengé (the Turkish name of a village which later would become the city of Constanța). Petre, born on May 26, 1933, in Constanța, was the son of Theodor (born in Constanța) and Ecaterina (born in Varna, Bulgaria). He received a solid education. His father took him to the Greek school, saying: "...you have a Greek name, but you should know that you are Romanian, like your father, who fought for this country in the First World War, which you should love as I myself do" [3]. After graduating from primary school Petrache followed the subsequent grades (1944-1951) at "Mircea the Great," the oldest and most prestigious high school for boys in Constanța. The majority of professors obtained Ph.D. titles from German or French universities. Many cultural events, including conferences of great scientists and writers, took place throughout the year in the performance hall of the school.

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P. T. Frangopol chose to become a chemist, following the example of some members of his family. He graduated from the Chemical Engineering Department, Polytechnical Institute of Iași in 1956 and would receive his Ph.D. (Dr. Eng.) in 1968 at another prestigious university, the Polytechnical Institute of Timișoara, under the supervision of Giorgio Ostrogovich, Department of Organic Chemistry.

P. T. Frangopol recalled [3] Academician Horia Hulubei as most important for his own achievements in life. In 1956 a new Soviet nuclear reactor (cyclotron and betatron) was installed in București-Măgurele, Romania thus becoming the 7th country in the world to have a nuclear reactor. A new Institute of Atomic Physics (in Romanian, Institutul de Fizică Atomică, IFA) was founded in București-Măgurele, under the aegis of The Romanian Academy. The right person was chosen to organize IFA: Academician Horia Hulubei, who was the first Director (and Founder), of IFA.

Petre T. Frangopol presented in detail the history of IFA [4]. Two problems had to be quickly solved: a) to educate personnel qualified in the field of atomic and nuclear physics (and connected domains: radiochemistry and nuclear technologies); and, b) to set up, at IFA, laboratories specialized in these domains. To solve the problem of education, in 1956-1957 a special one-year program of studies under the aegis of IFA was organized. This program included 80 students selected by competition from among the graduates of different faculties of physics, chemistry and engineering of Romanian Universities or Polytechnics. The students were divided into four groups of 20 each, assigned to: radiochemistry, electronics, biology and medicine. The graduates were then assigned to the different collectives newly formed in 1957, either at IFA or at laboratories in universities, research institutes and in factories.

On the other hand, other new laboratories were set up at IFA. In 1960 Academician Horia Hulubei asked Petre T. Frangopol to found the Laboratory of Labelled Organic Compounds, together with Alexandru T. Balaban. Both of them graduated (1957) the special one-year program of studies in radiochemistry and nuclear technology organized under the aegis of IFA. They were assigned to radiochemistry (and to the cyclotron collective). From 1957 to 1963, Petre T. Frangopol was Staff member, Laboratory of Organic Chemistry (chaired by Academician Costin D. Nenițescu) at București Polytechnical Institute, being paid by IFA and having research topics of IFA. Petrache recalled [4] that Horia Hulubei had asked him to take a temporary absence from the laboratory of Professor Nenițescu, to come to IFA and set up a laboratory for the preparation of organic compounds labelled with radioactive iodine (^{131}I) and other (radioactive and stable) isotopes. The technology would be further used by technicians hired specially for the production of these isotopes.

A. T. Balaban was a young lecturer in the Laboratory of Organic Chemistry chaired by Academician Nenițescu (who also supervised Balaban's Ph.D. work). In parallel, Balaban was hired at IFA in 1956. However, Academician Nenițescu asked Alexandru to fulfill all his duties as lecturer (seminars and laboratory work with students). Under these conditions, Petre was forced to set up alone the laboratory.

Such a laboratory had not existed previously in Romania. Petre has not received an adequate space for the laboratory, but a huge empty room – a corridor in the basement, several meters below ground. There, they installed a hood, projected by Petre and made by excellent craftsmen hired by IFA. After 7 months, the group succeeded to prepare, for the first time in Romania, ¹³¹I, widely used afterwards for treating diseases of the thyroid.

IFA became a multidisciplinary center of excellence [4]. In the first 6 years after its foundation, over 80 scientific articles have been published by researchers at IFA. Frangopol and Balaban were among the best young researchers of IFA. They performed successful studies aimed to solve important practical problems. An important line of research was the preparation and investigation of stable free radicals for studies of Electron Spin Resonance (ESR), also called Electron Paramagnetic Resonance (EPR), using the ESR spectrometer made by electronics specialists at IFA. It was first necessary to prepare the stable free radical 1,1-diphenyl-2-picrilhydrazyl (DPPH), which is used as standard of the position and intensity of ESR signals. This was the starting point for the development of a domain of basic research at IFA. Other stable free radicals have been prepared, many of them with the essential help of Mioara Frangopol, the distinguished wife of Petre T. Frangopol. Several articles were published in the prestigious journal *Tetrahedron*, mentioned in ref. [4]. Moreover, collaboration of Petre and Mioara Frangopol with other scientists has started. The work on stable free radicals of the group at IFA gained international recognition, being cited in several well known books by foreign researchers [5–7].

As a result of his many scientific accomplishments, P.T. Frangopol obtained financial support for research in Canada (Post Doctoral Fellow, National Research Council, Ottawa, Ontario, 1969-1970), U.S.A. (Post Doctoral Research Associate, with a NASA contract at the George Washington University, Department of Chemistry, Washington, D.C., 1970-1971), and Germany (Dozentenstipendium, Humboldt Foundation, 1972). He was also cited in many articles in leading (mainstream) journals and books published by well known publishers. As a result he was invited to present lectures (as plenary lecturer or key speaker) at many scientific events, Universities, and Institutions around the world: U.S.A. (Gordon Conferences, Argonne National Laboratory, Brookhaven National Laboratory, George Washington University,

Washington DC, Colorado University at Boulder, University of Illinois Urbana etc.), Sweden (Umeå University, Stockholm University), France (Centre d'Etudes Nucleaires de Grenoble et de Saclay), Belgium (Leuven University), Germany (Marburg/Lahn University, German Chemical Societies Annual Meetings), EUCHEM Conferences, Slovakia (Bratislava University), Greece (Athens, Thessaloniki, Patras and Ioannina Universities), former USSR (Novosibirsk Institute of Organic Chemistry, Moscow Institute of Chemical Physics) etc.

Although P.T. Frangopol received many offers to settle abroad, he returned to IFA, since he was leading a laboratory founded and equipped by him at international standards, with technologies of preparation and techniques for measuring the organic compounds labelled with radioactive isotopes developed for the first time in Romania. Unfortunately, his laboratory was completely destroyed by fire during the 1977 earthquake.

In 1976 IFA was reorganized, the Laboratories of physics became institutes, and the name of IFA was changed to "Horia Hulubei" National Institute for Research & Development in Physics and Nuclear Engineering (in Romanian Institutul de Cercetare-Dezvoltare pentru Fizică și Inginerie Nucleară „Horia Hulubei”, abbreviated as IFIN-HH). Petre T. Frangopol had an essential role in organizing a Center of Radiochemical Production, beginning with documentation, project, development of technologies for production of radiopharmaceutical and radioisotopes. Moreover, the results of researches had to have direct economic applications, i.e., to be sold, as no financial support from the budget of Romania was provided before 1989, according to the policy of the communist regime. Thus, the second period of P.T. Frangopol's work at IFA began (1977-1990), when he had again to start everything from scratch: finding the space for the Laboratory for Production of Radioactive Isotopes, procurement and installation of the necessary equipment, in addition to finding the sources for self-financing the production of radioactive isotopes (^{32}P , ^{45}Ca , ^{59}Fe , ^{35}S , ^{192}Ir , $^{99\text{m}}\text{Tc}$) to be used in industry, agriculture, biology and especially in medicine.

P.T. Frangopol extended later his activity, from organic physical-chemistry and radiochemistry, to biophysical chemistry and biophysics. He was the editor of the first annual publication of biophysics in Romania: *Seminars in Biophysics*, a series of 6 annual volumes (1985-1990) published in English by IFA. He developed new projects of applied research having national and international impact, using the equipment built at IFIN: the electron spin resonance (ESR) spectrometer ART-6, the nuclear magnetic resonance (NMR) spectrometer etc. In addition, P.T. Frangopol initiated and managed an extended program of biophysical studies on the interaction of medicines with cell membranes, financed by the Ministry of Chemical Industry. The program (pursued from 1981 till 1991) involved groups of researchers from Bucharest, Cluj-Napoca and Iași.

I met Petre T. Frangopol for the first time in 1976, when he came to the Department of Biochemistry, Faculty of Medicine, Institute of Medicine and Pharmacy Cluj-Napoca (today "Iuliu Hațieganu" University of Medicine and Pharmacy, Cluj-Napoca), where I was a young Lecturer. Petre introduced himself and said that he was the leader of a group of researchers from IFA and made a proposal to collaborate with him, since he believed we had mutual research interests in studies using spin labels. He had heard that I had just returned from the U.K., after 12 months of post-doc work in the laboratory of Professor Dennis Chapman, a well-known scientist in the field of biological membranes. My project involved the study of protein-lipid interactions in biological membranes using several techniques, including NMR, spin labelling ESR etc. I published several articles with the British scientists [8, 9] and with Vasile V. Morariu, a former high school colleague (and an excellent Romanian scientist) [10, 11]. I was honoured that such an outstanding scientist as Petre T. Frangopol (11 years older than me, with so many accomplishments) was inviting me to collaborate with him.

After visiting his laboratory in București-Măgurele, I realized that he was really a world-class scientist. In addition, I met his wife, the distinguished Mioara Frangopol, who impressed me deeply, by her competence as a scientist and also by her humane qualities. She was very intelligent. She always found the best ways to perform excellent laboratory work even if the conditions were not as good as in laboratories from abroad. She was always very kind and ready to help as much as she could any person who deserved to be helped. I realized that actually at IFA there was the "Professor Petre T. Frangopol and Dr. Mioara Frangopol group," Mioara being a strong support for Petrache, giving him the best advice in all situations.

A very fruitful collaboration started between the "Frangopol group" in București-Măgurele and the two groups in Cluj-Napoca: V.V. Morariu's group at I.T.I.M. and Benga's group at „Iuliu Hațieganu” University of Medicine and Pharmacy (where I was nominated in 1978 as Chief of the new Discipline of Cell Biology). Our groups have published many papers over several decades [12-15]. In addition, it was for us, the people from Cluj-Napoca, the chance of becoming close friends to Petrache Frangopol. I have learnt a lot of things from him, not only scientific, but also how to write the applications to obtain financial support in Romania, mainly from *The Academy of Medical Sciences* and *The National Council for Higher Education Scientific Research* (in Romanian *Consiliul Național al Cercetării Științifice din Învățământul Superior*, CNCSIS).

Based on his experience at IFA, Petre T. Frangopol was invited in 1990 as Professor at the University "Alexandru Ioan Cuza" (UAIC) Iași, to set up a Section of Biophysics at the Faculty of Physics. He received nothing in terms of spaces and funding of laboratories, since the UAIC leaders claimed that

funding received from the Ministry of Education was provided only for existing sections (not for a new one). Based on his experience from București-Măgurele, P.T. Frangopol obtained annual finances from the Ministry of Research in Romania for his two new laboratories at UAIC: one was the Laboratory of Medical Physics (the first such laboratory in Romania), and the other was the Laboratory of Biophysics (the second such laboratory after that of the București University). In addition, Professor Frangopol obtained funding (over 500,000 USD) by international competition, from the International Atomic Energy Agency, from the European Union programs (Erasmus, Copernicus) etc. Although Professor Frangopol obtained funding, UAIC offered him only a basement space for setting up the laboratories. During his tenure at UAIC, Professor Frangopol edited a series of 6 annual volumes (1992-1997) *Current topics in Biophysics*, published in English by Iași University Press. He invited authors from over 35 Universities and Scientific Institutions from 13 countries (U.S.A., Canada, Japan, and Europe) to provide scientific literatures for the bachelor's degree students. He also sent his students abroad, to perform the experimental work for their Ph.D. degree in well equipped laboratories, with which scientific collaboration was established. The results were published in international scientific journals. He supported the further development of the graduates of his Section of Biophysics at well-known universities. Some of them became Professors at: Free University of Berlin, Graz University (Austria), Athens University (Greece), Umeå University, Linköping University (Sweden), University College Dublin (Ireland), University of California at Irvine, Stanford University, Texas A&M University (USA), University of Queensland (Australia) etc.

P.T. Frangopol was Professor of Biophysics and Medical Physics at UAIC from 1991 to 1999. He continued his academic career as Professor of Biophysics and Biophysical Chemistry at the „Babeș-Bolyai” University (Faculty of Chemistry), Cluj-Napoca (1999-2002), the “Vasile Goldiș” Western University Arad (Faculty of Medicine) and the Department of Physics, Polytechnica University București (2002-2004). Everywhere, Petre was highly appreciated by the colleagues and students alike, for his competence, as well as for his unique scientific and humane qualities.

From 2012 to 2016, Petre T. Frangopol was the Editor-in-Chief of *Revista de Politică Științei și Scientometrie*, a journal of CNCSIS and The Ministry of Education and Research (which stopped funding of the journal in 2016). He published a lot of important articles on the problems of the Romanian education and research, i.e., the *Science Policy*. The articles were first published in the weekly supplement *Aldine* of the journal *România Liberă*. Then he compiled the articles assembling 7 volumes entitled „*Mediocrity and Excellence: a radiography of science and education in Romania*”, published from 2002 to 2019.

He was also member of the Editorial Board of several important journals from Romania and abroad: *Revue Roumaine de Chimie*, *Journal of Radioanalytical and Nuclear Chemistry*, *Scientometrics*.

P.T. Frangopol had many fields of interest: Chemistry, Radiochemistry, Physical Organic Chemistry, Biophysical Chemistry, Biophysics, Medical Physics, Archaeometry, Oceanography, Science Policy, Management of Science Policy, Scientometrics, and History of Chemistry in Romania.

Over the years, P.T. Frangopol initiated and organized or co-organized many scientific events: multidisciplinary seminars at IFA; four national conferences of the chemical physics program (1986-1989, Iași, Cluj-Napoca, București, some lectures being published in special issues of *Revue Roumaine de Biochimie*); Seminars on some Romanian original drugs, procain-based drugs, Gerovital H₃, and Aslavit, Trofopar and Boicil: analytical methods and effects on cell membranes (1983, 1984); two Romanian Conferences on the Application of Physics Methods in Archaeology, Cluj-Napoca, 1987 and 1989 (with volumes published each time); the 8th workshop “Balcanic Days of Biochemistry and Biophysics”, organized for the first time in Romania, Cluj-Napoca, 1990, with Vasile V. Morariu) etc.

Petre T. Frangopol was Scientific Counselor at CNCS/IS. He contributed to making possible the access of Romanian scientists to Science *Citation Index*, published first by the Institute of Scientific Information of Philadelphia, known as ISI Thomson Reuters. This database is now managed by Clarivate Analytics.

Unsurprisingly, the achievements of P.T. Frangopol were recognized by many prizes and distinctions received throughout his life: the “Constantin Miculescu” Prize of the Romanian Academy (1990, for his work on the biophysics of the interaction of Romanian drugs with cellular membranes), the “Horia Hulubei” Diploma (2006, for his outstanding contribution to the development of IFA), Honorary Professor of The “Iuliu Hațieganu” University of Medicine and Pharmacy Cluj-Napoca (2008), the Great Honor Diploma of the National Commission of Archeometry (1997, awarded by the National Museum of History of Transylvania, Cluj-Napoca), the Diploma of Honor of the National Institute of Marine Research (Constanța), Diploma of Excellence awarded by the University of Bucharest (2018), Honorary Citizen of Constanța (2019).

P.T. Frangopol was elected Honorary Member of The Romanian Academy in 2012. I was very pleased to sustain him on the occasion of the Meeting of the Romanian Academy when he was discussed, answering to some queries formulated by venerable members present in the Aula (who were surprized by the many achievements of Petre T. Frangopol). Subsequently, as a Member of the Academy, P.T. Frangopol proved his value, expressing many overtly thoughtful positions on important matters of the Academy’s life (including

opinions regarding the candidates for the Academy's leadership). He was nominated by the Section of Chemical Sciences to coordinate the writing of the ample volume on the "History of Romanian Chemistry", published in 2018 by the Romanian Academy Publishing House in the jubilee series on the Romanian Civilization. He did a wonderful job. Unfortunately, Vasile V. Morariu's file has not been discussed by the Section of Biological Sciences of The Romanian Academy while he was alive! Vasile and myself wrote in 2013 a short presentation of the Romanian Biophysics Research School founded by Professor Petre T. Frangopol. The conclusion is really in the title of our article [16].

P.T. Frangopol (Petrache) will be greatly missed by many academics, scientists, former students, friends, and by all who had the pleasure of interacting with him over several decades. I will be grateful to him all my life, considering not only the scientific publications we accomplished, but for many other reasons: the support and competent advice he gave me along the decades, when I had to face a variety of obstacles from various institutions and persons. Petrache came to Cluj-Napoca to participate in all scientific events I organized over almost five decades. He accepted to give the Opening Plenary Lecture at „The Second World Congress on Water Channel Proteins (Aquaporins and Relatives), celebrating the 30th Anniversary of the Discovery of the First Water Channel Protein (Later Called Aquaporin 1)” Cluj-Napoca, Romania, 6-10 May 2015.

Finally, I express again deep regrets for the greatest loss of his life, the death of his beloved Mioara Frangopol, after a long incurable illness.

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