UDK 577.1 : 61 **ISSN 1452-8258**

J Med Biochem 30: 160–166, 2011

Technical reports
Obaveštenja

100-GODIŠNJICA ROĐENJA PROFESORA IVANA BERKEŠA: ŽIVOT I DELO

THE 100th ANNIVERSARY OF THE BIRTH OF PROFESSOR IVAN BERKEŠ: HIS LIFE AND WORK

U Beogradu je 16. novembra 2010. godine održana Trinaesta godišnja naučna konferencija posvećena 100-godišnjici rođenja Profesora Ivana Berkeša u okviru koje su stručnjaci iz Beograda (N. Majkić-Singh, S. Stanković), Zagreba (S. Margetić) i Skoplja (S. Efremova-Aaron) u kojima je profesor Ivan Berkeš živeo i radio, održali svoja predavanja. Takođe su tradicionalno iz Naučnog fonda »Profesor Ivan Berkeš« dodeljene diplome i novčane nagrade najboljim studentima Farmaceutskog fakulteta u Beogradu i to: Zori Ćetković i Jeleni Joksić.

Profesor Ivan BERKEŠ, značajna ličnost u oblasti farmacije i medicine, utemeljivač je medicinske biohemije i kliničke enzimologije u zdravstvu Srbije i Jugoslavije. Pod njegovim rukovodstvom na Farmaceutskom fakultetu u Beogradu školovale su se generacije medicinskih biohemičara tako da u dugom periodu u Srbiji nije bilo ni jedne laboratorije, a da u njoj nije radio đak profesora Berkeša. Profesor Berkeš osnovao je medicinsku biohemiju i utemeljio je kao naučnu i zdravstvenu disciplinu u Srbiji. Njegovo delo ostaće trajno da živi kroz ove i buduće generacije medicinskih biohemičara, koji su mu na tome neizmerno zahvalni i sećaće ga se sa izrazima poštovanja i ljubavi.

Prof. dr Ivan BERKEŠ rođen je 13. XI 1910. godine u Bjelovaru gde je završio klasičnu gimnaziju (latinski i nemački 8 godina, 6 godina grčki). Na Farmaceutskom odseku Filozofskog fakulteta u Zagrebu diplomirao je 1933. godine. Treba pomenuti da je Ivan Berkeš završio praksu u apoteci kod Stanislava Ilakovca u Zagrebu, a u toku studija slušao je sledeće predmete: fiziku kod Prof. Hondl-a, botaniku kod Prof. Vouk-a, hemiju kod Prof. Bubanovića, farmakognoziju kod Prof. Vrgoč-a, farmaceutsku hemiju kod Prof. Fluniania i farmaceutsku tehnologiju kod Prof. Benzinger-a. 1936. godine Ivan Berkeš diplomirao je i 7. grupu hemije (a. hemija, b. eksperimentalna fizika, c. fizička hemija, viša matematika, mineralogija i botanika) na Filozofskom fakultetu u Zagrebu.

On November 16th, 2010, the Thirteenth Annual Scientific Conference dedicated to the 100th anniversary of the birth of Professor Ivan Berkeš was held in Belgrade, during which experts from Belgrade (N. Majkić-Singh, S. Stanković), Zagreb (S. Margetić) and Skopje (S. Efremova-Aaron), the cities where Prof. Ivan Berkeš lived and worked, gave their lectures. Also, diplomas and money awards were traditionally presented by the Scientific Fund »Dr Ivan Berkeš« to the best students of the Faculty of Pharmacy in Belgrade: Zora Ćetković and Jelena Joksić.

Professor Ivan BERKEŠ, an important figure in the field of pharmacy and medicine, was the founder of medical biochemistry and clinic enzymology in the health care of Serbia and Yugoslavia. Under his guidance, many generations of medical biochemists were educated at the Faculty of Pharmacy in Belgrade, and for a long time there was no laboratory in Serbia that did not employ one of Prof. Berkeš's students. Prof. Berkeš founded Serbian medical biochemistry and established it as a scientific and health discipline. His work will live on through these and the future generations of medical biochemists, who remain eternally grateful and promise to honor his memory with love and respect.

Prof. Dr Ivan BERKEŠ was born on November 13th, 1910, in Bjelovar, where he was educated at the Classical Gymnasium (studying Latin and German for 8, and Greek for 6 years). In 1933 he graduated from the Department of Pharmacy of the Faculty of Philosophy in Zagreb. It should be mentioned that he completed his internship at the Pharmacy of Stanislav Ilakovac in Zagreb, having taken the following classes during the course of his studies: Physics with Prof. Hondl, Botany with Prof. Vouk, Chemistry with Prof. Bubanović, Pharmacognosia with Prof. Vrgoč, Pharmaceutical Chemistry with Prof. Fluniani and Pharmaceutical Technology with Prof. Benzinger. In 1936 Ivan Berkeš also graduated from the 7th group of Chemistry (a. Chemistry, b. Experimental Physics, c. Physical Chemistry, Higher Mathematics, Mineralogy and Botany) at the Faculty of Philosophy in Zagreb.

Ivan Berkeš sa kolegama na studijama u Zagrebu
Ivan Berkeš with colleagues during his study in Zagreb

Profesor Ivan Berkeš

1937. godine odslužio je vojni rok u Nišu, Prizrenu i Zagrebu.

Doktorat filozofije (struka hemija) stekao je 1939. godine na Univerzitetu u Zagrebu. Iste godine izabran je za asistenta Hemijskog zavoda Medicinskog fakulteta, čiji je upravnik bio profesor F. Bubanović.

1941. godine dr Ivan Berkeš je otpušten iz službe, a 1942. godine interniran u koncentracioni logor Kraljevica-Rab. U periodu od 1943. do 1945. godine bio je aktivni učesnik NOR-a. Nakon rata u periodu od 1945–1947. godine dr Ivan Berkeš je obavljao više funkcija pri državnom Institutu za hemijsko-farmaceutsku proizvodnju u Beogradu, gde je bio pomoćnik upravnika a docnije i upravnik ovog Instituta. Od 1947–1948. godine radio je kao naučni saradnik u službi Reparacione komisije u Budimpešti, da bi 1949. godine ponovo stupio na Institut za hemiju Medicinskog fakulteta u Zagrebu, gde je ostao do 1953. godine.

Od 1953. do 1960. godine dr Ivan Berkeš je radio na Medicinskom fakultetu u Skoplju gde je izabran za vanrednog profesora biohemije. U tom periodu osniva Biohemijski institut na istom fakultetu.

Godine 1960. prelazi u Institut za biohemiju Farmaceutskog fakulteta u Beogradu. U zvanje redovnog profesora medicinske biohemije izabran je 1964. godine. Na ovom fakultetu, kao dugogodišnji upravnik Zavoda za biohemiju, radio je sve do penzionisanja 1978. godine.

Dr Ivana Berkeša uveo je u naučni rad kolektiv asistenata Profesora Bubanovića, sa kojima je drugovao od svoje treće godine studija kad je postao demonstrator. Među asistentima na njega je naročito uticao

During 1937, he completed his military service in Niš, Prizren and Zagreb.

Ivan Berkeš obtained a doctorate in philosophy (namely, chemistry) in 1939 at the University in Zagreb. That same year, he was elected as an assistant at the Chemical Institute of the Faculty of Medicine, whose head at the time was Prof. F. Bubanović.

In 1941, Dr Ivan Berkeš was dismissed from employment and the following year imprisoned at the concentration camp Kraljevića-Rab. From 1943 to 1945 he was actively involved in the National Liberation War. After the war, between 1945 and 1947 Dr Ivan Berkeš held various functions at the state Institute of Chemical-Pharmaceutical Production in Belgrade, serving as the assistant director and later director of this Institute. In the period of 1947–1948 he worked as a scientific advisor for the Reparation Committee in Budapest, after which he rejoined the staff of the Institute of Chemistry of the Faculty of Medicine in Zagreb, where he worked until 1953.

Between 1953 and 1960 Dr Ivan Berkeš taught at the Medical Faculty in Skopje, where he had been elected as an Associate Professor of Biochemistry. In that period he formed the Biochemical Institute at this Faculty.

In 1960 Dr Ivan Berkeš joined the Institute of Biochemistry of the Faculty of Pharmacy in Belgrade. He was elected Senior Professor of Medical Biochemistry in 1964, and remained at this faculty, as a long-term director of the Biochemistry Institute, until his retirement in 1978.

Zora Ćetković prima diplomu od N. Majkić-Singh

Jelena Joksić prima diplomu od N. Majkić-Singh

Igor Berkeš pozdravlja učesnike Naučne konferencije

Predavači na Naučnoj konferenciji (s leva na desno: J. Bašić, S. Stanković, N. Majkić-Singh, S. Efremova-Aaron)

Tomislav Pinter, koji ga je uveo u tajne analitičke i fizičke hemije. U praktičnom radu posebno mu je pomagao Miloš Mladenović, kasnije takođe profesor na Farmaceutskom fakultetu u Beogradu, koji ga je uveo u organsku preparativnu hemiju i mikroanalizu po Preglu (1931. godine).

Po sugestiji Dr Mladenovića radio je na izolaciji i određivanju funkcionalnih grupa politerpenskih kiselina α-elemi i β-elemonske kiseline. Tako su objavljeni prvi radovi o novim derivatima dihidro- i dibromelemonske kiseline, kao i dr- i tetraozonida. Disertacije Ivana Berkeša pod naslovom »Prilog poznavanju elemi smole«, Filozofski fakultet, Zagreb 1939. godine, je rezultat eksperimenata iz te oblasti.

Dr Ivan Berkeš was introduced into the scientific work of the Faculty by Prof. Bubanović's assistants, with whom he was friends since his third years of studies when he was appointed class demonstrator. Among the assistants, the one who exerted a special influence on Dr Berkeš was Tomislav Pinter, who revealed to him the secrets of analytical and physical chemistry. The help of Miloš Mladenović, later also a Professor at the Faculty of Pharmacy in Belgrade, was particularly valuable in practical work, as he brought him into preparative organic chemistry and Pregl's micro-analysis (1931).

Upon suggestion by Dr Mladenović, Prof. Ivan Berkeš worked on isolating and determining the functional

Sa dr Pinterom, radio je na više problema iz koloidne hemije, kao i neorganske analitike čiji rezultati nisu bili ni završeni ni publikovani zbog ratnih događanja. Posle rata štampana je studija o kompleksnim heksacijanidima.

U svom radu na elektrohemijskoj analitici (uticaj Prof. Tutundžića) gde se upoznao sa potenciometrijom i ampermetrijom, stvorio je bazu za uvođenje elektroforeze u široku praksu. Ova moderna tehnika postala je interesantna za kliničku biohemiju pošto su Wunderly i Quhramann popularisali slobodnu elektroforezu po Tiseliusu. Iz materijalnih razloga, a naročito praktično-rutinskih uslova bilo je nemoguće da se velika i glomazna aparatura koristi na klinikama i bolničkim laboratorijama. Zato je dr Berkeš dao više metodskih rešenja za papirnu elektroforezu od kojih je jednu već krajem 1950. godine prikazao na sastanku »Društva za eksperimentalnu medicinu« u Zagrebu. Prva publikacija osvanula je 1950. godine u Liječničkom Vjesniku. On je prema tome bio jedan od prvih istraživača na tom polju u svetu, pa su njegove publikacije citirane u skoro svim monografijama koje su se bavile ovom problematikom (Block-Durrum, Antwiler, Hais-Macek, Michael Lederer, Ribeiro i sar., Mc Donald), kao i u nizu kliničkih radova.

Osim metodičkog uspeha koji je zabeležen patentom (aparati tog tipa nalaze se još uvek u ponekoj i beogradskoj laboratoriji) publikovan je i niz kliničkih radova, kao što je primena elektroforeze kod jetrenih oboljenja, mieloma, transudata, eksudata, imunoloških rakcija. Svakako je najinteresantnija studija nefrotskog sindroma kod dece pri čemu je status bio određen elektroforezom nekoncentrovanog urina i seruma uporedo (1952), što je predloženo kao diferencijalno-dijagnostička metoda.

Prelazom na hromatografiju aminokiselina iz protamina riba (B. Briski) određena je molekulska veličina tih proteina. U nastavku pokušaja da se karakterišu pojedini protamini iz smeše uz pomoć insulina (insulin-protamin) inaugurisana su razdvajanja proteina hromatografijom na hartiji. Odatle je dalje logički sledilo ispitivanje čistoće insulina i njegovih disocijacija na protomere (sa P. Berkeš). Pošto je doziranje insulina bilo veoma nesigurno na isečcima tkiva u Warburgovom respiratometru, učinjen je pokušaj da se biološka aktivnost meri na suspenziji izolovanih ćelija (npr. tumora), ali je najjednostavniji put izgledao da se radi sa kvascem. Sva ta istraživanja registrovana su publikacijama u kojima je dokazan određen ali nespecifičan uticaj proteina (a naročito insulina) na transport kroz membranu. Odatle datira preokupacija dr Ivana Berkeša za sastav i strukturu membrane kao i za mehanizam transporta, kojim se škola Prof. Berkeša bavila više sledećih godina.

Po dolasku u Beograd Prof. Berkeš je niz godina radio po projektu sa RZN SR Srbije na temi »Tiolska funkcija«. Prvo je uvedena vrlo tačna i specifična amperometrijska titracija slobodnih sulfhidrilnih grupa u niže-

groups of polyterpene acids in α-elemi and β-elemonic acids. This led to the publication of the first papers about the new derivatives of dihydro- and dibromine-elemonic acid, and di- and tetraozonide. Ivan Berkeš's dissertation entitled »An Addition to the Knowledge of Elemi Resin«, Faculty of Philosophy, Zagreb, 1939, is the result of experiments in this field.

Together with Dr Pinter he worked on several problems in colloid chemistry and inorganic analytics, the results of which were never completed nor published due to war operations. A study on complex hexacianides was published after the war.

Through his work in electrochemical analytics (under the influence of Prof. Tutundžić), where he became acquainted with potenciometry and amperometry, he created a basis for the introduction of electrophoresis into wide practice. This modern technique became a focus of interest for clinical biochemistry after Wunderly and Quhramann popularized free electrophoresis according to Tiselius. Due to financial reasons, especially the practical-routine conditions, it was impossible to use the large and bulky apparatus in clinics and hospital laboratories. Dr Berkeš, therefore, offered several method solutions for paper electrophoresis, one of which he exhibited towards the end of 1950 at a meeting of the Society for Experimental Medicine in Zagreb. The first publication appeared in 1950 in the Medical Newsletter. Thus he became one of the first investigators in this field in the world, and his publications were cited in nearly every monograph dealing with this topic (Block-Durrum, Antwiler, Hais-Macek, Michael Lederer, Ribeiro and Assoc., McDonald), as well as in numerous clinic papers.

Along with the methodical success achieved with the patent (apparatuses of such type can still be found in some Belgrade laboratories), a series of clinic papers were published, such as on the application of electrophoresis in liver diseases, myeloma, transudate, exudates, immunologic reactions. Certainly the most interesting is the study of nephritic syndrome in children, where the status was determined by parallel electrophoresis of unconcentrated urine and serum (1952), which was suggested as a differential-diagnostic method.

The transition to chromatography of amino-acids from fish protamines (B. Briski) marked the molecular size of these proteins. Continuing efforts to characterize individual protamines from the mixture by using insulin (insulin-protamine) inaugurated the separation of protamines by paper chromatography. Investigations of insulin purity and its dissociations into protomers (with P. Berkes) logically followed. Since the dosing of insulin was highly insecure on tissue carvings in Warburg's respirometer, an attempt was made to measure biological activity in a suspension of isolated cells (e.g. tumours), but the simplest way seamed to involve yeast. All these investigations were registered in publications where proteins (especially insulin) were proved to have a determined

molekulskim jedinjenjima i proteinima. Ona je poslužila u prvom redu pri ispitivanju trovanja ugljendisulfidom. Najznačajniji rad u tom domenu je amperometrijsko određivanje aktivnosti enzima dimetiloetin: homocistein metilferaze (2.1.1.3), čime je otvoreno novo područje rada, koje nažalost nije dalje prošireno i korišćeno.

Kada je postalo jasno da kliničko ispitivanje aktivnosti transaminacije može da pruži korisne podatke u dijagnostici, na Farmaceutskom fakultetu u Beogradu pod rukovodstvom Prof. dr Ivana Berkeša je doktorirao mr Božidar Štraus (1962) ispitujući tu pojavu na eritrocitima. Prof. Berkeš koji je bio njegov mentor usmerio je daljna istraživanja na eritrocitu u smislu principijelnog učešća C-4 dikarbonskih kiselina u transportu na membrani (M. Stanulović, 1966). Po koncepciji Prof. Berkeša ove kiseline imaju presudnu ulogu u energetskom snabdevanju eritrocita kao i u transportu alkalnih jona kroz membranu. U nizu radova nastavljeno je istraživanje transaminacije, transporta određenih organskih kiselina kroz membranu i njihova uloga kao supstrata (N. Majkić). Osim ovog rađeno je i na ispitivanju respiracije uz metilensko plavo, na redukciji methemoglobina u dva prisutna sistema kao i na udelu ATP-aza u transportu. Na ovoj problematici koja je planirana kroz projekat »Istraživanje normalnog metabolizma eritrocita« finansiranog od strane RZN SR Srbije, magistriralo je i doktoriralo više kandidata Prof. dr Ivana Berkeša.

Više godina Prof. Ivan Berkeš sa istom Zajednicom je imao ugovor vezan za temu »Dokazivanje, određivanje i izolacija enzima krvi«, gde su naročito bili zapaženi eksperimenti koji su se bavili određivanjem fenotipske raspodele enzima eritrocita kod populacija koje žive na teritoriji SR Srbije, kao i pojedinih etničkih grupa (ispitani su enzimi kisela fosfataza, adenilat-kinaza, fosfo-glukomutaza itd.)

U toku skoro 20 godina Prof. Ivan Berkeš je uložio veliki trud u metodološka istraživanja u kliničkoj biohemiji, opštoj i kliničkoj enzimologiji. O tome svedoče brojni specijalistički radovi, magistarske i doktorske teze koji reflektuju precizno koji je problem u određenom momentu bio aktuelan u našim uslovima. Treba samo prelistati naslove od oko 150 specijalističkih radova koji su rađeni pod njegovim rukovodstvom ili je samo sugerisao teme, pa da se vidi koja je tematika bila aktuelna.

Vredno je takođe pomenuti da je po ideji Prof. Ivana Berkeša na Farmaceutskom fakultetu izrađena doktorska disertacija (N. Majkić) koja je za osnovu imala postavljanje kinetičkih metoda za određivanje jednog broja oksidaza (anaerobne transhidrogenaze) koje se zasnivaju na oksidaciji hromogena ABTS. Kasnije su ovi eksperimenti poslužili kao polazni osnov za postavljanje metoda za određivanje jednog broja supstrata (npr. glukoza, holesterol, alkohol), za koje je

although unspecific influence on membrane transport. This is where Dr Ivan Berkeš's preoccupation with the composition and structure of the membrane and its transport mechanism originated, which will be the focus of study for his school during the years to come.

Upon arriving in Belgrade, Prof. Berkeš worked for several years on projects for the Republic Science Institute of the Federal Republic of Serbia, under the topic »Thiol Function«. First, the highly accurate and specific amperometric titration of free sulphhydryl groups in low-molecular compounds and proteins was introduced. It served primarily for the investigations of carbon disulphide poisoning. The most significant achievement in this domain is the amperometric determination of the activity of enzyme dimethyleethine: homocysteine methylferase (2.1.1.3), which opened a new field of study that was unfortunately never fully expanded and used.

When it became clear that clinic investigations of transamination activity can yield useful diagnostic data, at the Faculty of Pharmacy in Belgrade under the guidance of Prof. Dr Ivan Berkeš, Mr Božidar Štraus obtained a doctor's degree (1962) by examining this phenomenon on erythrocytes. As his mentor, Prof. Berkeš aimed further research at erythrocytes, in the sense of principle involvement of C-4 dicarbonic acids in membrane transport (M. Stanulović, 1966). According to Prof. Berkeš's conception, these acids have a crucial role in providing energy to erythrocytes as well as in alkaline ions transport through the membrane. Through a series of papers research continued, focused on transamination, transport of certain organic acids through the membrane and their role as substrates (N. Majkić). Beside this, investigations were undertaken regarding respiration with methylene blue, reduction of methhemoglobin into two systems present, as well as the involvement of ATPases in transport. Several of Prof. Dr Ivan Berkeš's candidates obtained their master's and doctor's degrees for their work under this topic, which was part of the project »Investigation of Normal Erythrocyte Metabolism« financed by the Republic Science Institute of the Federal Republic of Serbia.

For many years Prof. Ivan Berkeš had a contract with the Institute related to the topic of »Evidence, Determination and Isolation of Blood Enzymes«, where experiments dealing with the determination of the fenotypic distribution of erythrocyte enzymes in populations living on the territory of the Federal Republic of Serbia, as well as certain ethnic groups, were given special attention (the following enzymes were investigated: acid phosphatase, adenilate-kinase, phosphoglucomutase etc.).

For nearly 20 years Prof. Ivan Berkeš invested all his efforts into methodological research in clinical biochemistry, general and clinic enzymology. Numerous specialist, master and doctoral theses testify to this fact, and these precisely reflect which problem was prioritized at which time in our community. One

pokazano veliko interesovanje kako kod nas tako i u svetu.

Za enzime Prof. dr Ivan Berkeš je počeo da se zanima kao nastavnik biohemije na Medicinskom fakultetu u Skoplju. U svom dugogodišnjem naučno-istraživačkom radu profesor Berkeš se naročito posvetio ispitivanju više klasa enzima. Bio je član Enzimske komisije Međunarodne federacije za kliničku hemiju. Kao utemeljivač kliničke enzimologije napisao je 1975. godine sa profesor Persidom Berkeš eminentno delo »Opšta i medicinska enzimologija«, kao prvu naučnu obradu enzima na našem jeziku, koju je Farmaceutski fakultet 1976. godine predložio za Oktobarsku nagradu Grada Beograda. Njegovo je ubeđenje bilo i ostalo da se metabolizam može naučiti samo uz poznavanje karaktera i osobina individualnih enzima. Iz toga razloga trasirao je »beogradsku školu enzimologije« kao pedagoško-publicističku i istraživačku.

U toku svog radnog staža Prof. dr Ivan Berkeš je objavio više knjiga i preko 200 naučnih radova u svetskim i domaćim časopisima. Rukovodio je nizom naučno-istraživačkih projekata, kojima se škola profesora Berkeša bavila i nakon njegovog odlaska u penziju.

Odmah po dolasku na Farmaceutski fakultet u Beogradu, Prof. dr Ivan Berkeš se posvetio stvaranju programa za specijalizaciju iz medicinske biohemije. U toku 18. godišnjeg perioda pod njegovim rukovodstvom specijaliziralo je preko 150 medicinskih biohemičara, a iz oblasti medicinske biohemije magistriralo i doktoriralo više desetina farmaceuta. Razvoju medicinske biohemije doprinosio je i svojim aktivnim radom u Saveznoj komisiji za medicinsku biohemiju i Sekciji za medicinsku biohemiju Farmaceutskog društva Srbije kao strukovnoj organizaciji. Dugogodišnjom naučnom i stručnom aktivnošću Prof. dr Ivan Berkeš je doprineo da se u srpskoj medicini i farmaciji utemelji medicinska biohemija kao savremena dijagnostička grana, pri čemu je profesor Ivan Berkeš svojim studentima, specijalizantima i poslediplomcima uvek nesebično prenosio svoja ogromna znanja.

Nama, njegovim đacima i sledbenicima, profesor Berkeš je istovremeno bio profesor, Učitelj, otac i prijatelj. Učio nas je tajnama i veštinama medicinske biohemije, ali i životnim istinama. Cenio je i podržavao svestrane ličnosti, hrabrost i odlučnost mladih ljudi. Nastojao je da utiče na razvoj istraživačkog duha kod svojih studenata.

Voleli smo da slušamo njegova predavanja zbog ilustrativnog pristupa teškoj materiji. Svi se kao da je bilo danas sećamo njegovih duhovitih primedbi zabeleženih u tekstovima naših magistarskih i doktorskih teza i specijalističkih radova. Iste greške nismo nikad ponovili. Stalno nas je usmeravao da težimo istini ali i da dostignemo nemoguće.

should only go through the titles of about 150 specialist papers done under his tutorship or upon his suggestion, to see which topic was in focus.

One other noteworthy reference could be made to a doctoral dissertation (N. Majkić) done at the Faculty of Pharmacy and based on the idea of Prof. Ivan Berkeš, which aimed to establish a kinetic method for the determination of a number of oxidases (anaerobic transhydrogenase) based on the oxidation of chromogen ABTS. These experiments later served as a foundation for establishing methods for the determination of a number of substrates (e.g. glucose, cholesterol, alcohol), which evoked much interest on the local as well as the global level.

Prof. Dr Ivan Berkeš became interested in enzymes as a biochemistry teacher at the Medical Faculty in Skopje. During his many years of scientific-investigative work, Prof. Berkeš was especially dedicated to examining several classes of enzymes. He was a member of the Enzyme Committee of the International Federation of Clinical Chemistry. As the founder of clinical enzymology, in 1975, together with Prof. Persida Berkeš, he wrote the famous work »General and Medical Enzymology«, the first scientific elaboration of enzymes in our language, nominated by the Faculty of Pharmacy in 1976 as the candidate for the October Prize of the City of Belgrade. Their belief, which they never abandoned, was that metabolism may be understood only with the knowledge of the nature and characteristics of individual enzymes. For that reason, he paved the way for the »Belgrade School of Enzymology« as a pedagogic-publicistic and research entity.

During his working years, Prof. Dr Ivan Berkeš published several books and over 200 scientific papers in renowned magazines in our country and worldwide. He mentored a series of scientific-research projects, the work continued by his school after his retirement.

Immediately after joining the staff of the Faculty of Pharmacy in Belgrade, Prof. Dr Ivan Berkeš became dedicated to creating a program for specialty studies in medical biochemistry. During the 18 years under his tutorship, more than 150 medical biochemists became specialists in this field, and several dozen pharmacists obtained their master's and doctor's degrees. Another way of contributing to the development of medical biochemistry was through his active engagement in the Federal Committee for Medical Biochemistry and the Section of Medical Biochemistry of the Pharmaceutical Society of Serbia as a professional organization. Owing to his many active years as a scientist and expert, Prof. Dr Ivan Berkeš helped to establish medical biochemistry as a contemporary diagnostic branch in Serbian medicine and pharmacy, whereby the professor unselfishly shared his vast knowledge with his students, interns and postgraduates.

To us, his students and followers, Prof. Berkeš was at the same time a professor, a Teacher, a father and a friend. He taught us the secrets and skills of medical

Profesor Berkeš je bio svestrana ličnost, voleo je muziku, slikao je, govorio 5 svetskih jezika, poznavao je istoriju, filozofiju. Bavio se dugi niz godina filatelijom. Svojim đacima bio je uzor u svakom pogledu. Potajno smo želeli da dostignemo samo delić njegove harizme. Cenili smo ga, uvažavali i poštovali. Ovo osećanje ostaće trajno u nama.

U Beogradu, 16. 11. 2010.
Prof. Dr Nada Majkić-Singh

biochemistry, but also the life's truths. He appreciated and supported open-mindedness, courage and determination in young people, encouraging students to develop a spirit of investigation.

We loved listening to his lectures, because of his illustrative approach to serious matters. His witty remarks still come to mind, recorded in the texts of our master and doctoral theses and specialists papers. We never repeated the same mistakes. He inspired us to reach for the truth, but also to achieve the impossible.

Prof. Berkeš was a versatile figure – he loved music, painting, spoke five languages, knew history, philosophy. He practiced philately for many years. He was a row model to his students in every respect. Our secret wish to have a hint of his charisma. We honored, admired and respected him. These feelings will always live within us.

In Belgrade, November 16, 2010
Prof. Dr Nada Majkić-Singh