

# Neuroscience and Neurosurgery in Southeast Europe

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## 1. Introduction

Neuroscience emerged as a consequence of the endeavors of many who conspired to illuminate the structure of the nervous system, the manner of communication within it, its links to reflexes and relation to more complex behavior (1). It is an interdisciplinary science that collaborates with many different fields such as chemistry, computer science, engineering, linguistics, mathematics, medicine, genetics, and allied disciplines including philosophy, physics, and psychology. The scope of neuroscience has broadened to include different approaches used to study the molecular, cellular, developmental, structural, functional, evolutionary, computational and medical aspects of the nervous system.

Recently, neuroscience and particularly neurogenetics, has made significant achievements mostly due to the contribution of the novel powerful technologies as for example array-CGH (Comparative genomic hybridization) and NGS (Next-generation sequencing). Our understanding of genetic variation underlying heritable neurological diseases, the detection of novel risk factors of common disorders and therapeutic interventions as a part of individualized medicine strategies have changed at a rate never possible before. The revolution in technologies and massive parallel sequencing are about to become part of routine clinical testing as a great number of rare disease genes have been recently identified. Generating the sequence data, however, is only half the run. In a diagnostic setting, the present challenge is to develop reliable and user-friendly bioinformatics pipelines for working with the vast amounts of sequence data. A comprehensive bioinformatics workflow requires data filtering, quality checking, variant annotation and interpretation etc. in order to identify the pathological reason for a given disease.

Neurosurgery is final stage of helping patients, as the result of all these efforts, but as much as surgical skill and technical advances are important, only understanding

new discoveries in other fields of neuroscience can open new possibilities in treatment of patients with neurological disorders. The new trend in the training of the new generations is to fill the gap between the tremendous achievements of Biomedicine and clinical applications and to enhance research collaboration.

In the light of the very fast research achievements and their application into clinical neurological and neurosurgical practice, the International Neuroscience Journal (INJ) appears just on time. It is important for the journal to elucidate the novel research and scientific achievements in the field of neuroscience and to provide broader collaboration possibilities between the researchers in this field. Multidisciplinary collaboration is required for successful application of clinical trials at local country level, which also requires communication at international level. It is highly expected the International Neuroscience Journal to build bridges between vast spectrum of neurosciences and neuroscientists and to help them work together for the patients' benefit.

Southeast Europe is a region consisted geographically and demographically from 14 countries within United Nations, in alphabetical order: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Hungary, Macedonia, Moldova, Montenegro, Romania, Serbia, Slovenia and Turkey. The first known use of the term "Southeast Europe" was introduced by Austrian researcher Johann Georg von Hahn (1811-1869) as broader term than traditional "Balkans". Although boundaries can vary greatly due to the political, economic, historical, cultural and geographic consideration of the observer, Southeast Europe region can be define among above mentioned countries and actual intention and consideration of Kosovo as a subject of territorial dispute vs. independent country (Wikipedia).

Neuroscience and neurosurgery in Southeast Europe in general has significant historical background and

important actual contribution to the global scientific quantum. Each country from the region has strong representatives and important achievements through the time within wide spectrum of basic neurosciences up to the neurosurgery. Having in mind those facts and taking in consideration importance of details in this field, writing an Editorial for International Neuroscience Journal Section Southeast Europe Volume 1, as regional editor-in-chief, about neuroscience and neurosurgery in Southeast Europe was more than difficult job. Among huge number of important people and facts in this subject doing my best to integrate all important things and not to miss something I would kindly like to express my deepest gratitude and respect to the Members of the Editorial Board of the International Neuroscience Journal Section Southeast Europe and distinguished colleagues (Acknowledgments) for helping me creating this Editorial with their active participation (Bulgaria, Croatia, Greece, Macedonia, Romania and Serbia).

Writing this Editorial, at the moment of finishing it due to the deadline I could not reach relevant information about neuroscience and neurosurgery in Albania, Cyprus, Hungary, Montenegro and Slovenia. I hope that in some of the following Volumes of International Neuroscience Journal, Section Southeast Europe, we will be able to publish important facts about historical background and current status of neuroscience and neurosurgery in Albania, Cyprus, Hungary, Montenegro and Slovenia, as well as data about neuroscience in Greece and Macedonia. Chapters considering neuroscience and neurosurgery in Bosnia and Herzegovina, Moldova and Turkey were written according to the relevant data from the available literature and sources of information.

Finally, taking in consideration different modalities of writing this Editorial, it seemed most appropriate to me to involve distinguished representatives in neuroscience and neurosurgery from each country, in order to obtain relevant details regarding neuroscience and neurosurgery in Southeast Europe.

## 2. Neuroscience and Neurosurgery in Bosnia and Herzegovina

The department was established in 1970 by Professor Zdravko Besarovic, a general surgeon, as a specialist unit distinct to that of General Surgery, the neurosurgical unit at Sarajevo University Medical Center. It started out as a small unit with eighteen beds. In 1979, it was formally recognized as the University of Sarajevo, Department of Neurosurgery and the number of beds had increased to thirty. The first neurosurgeon to complete his training in Bosnia and Herzegovina was Dr Faruk Konjhozic, who later took over as Head of Department.

During the war years (1992-1995), the department carried on as a functional unit despite the severe lack of resources. As Serbian forces surrounded Sarajevo and cut off all electricity and water, the neurosurgeons per-

severed on stubbornly achieving miraculous results. The workload which consisted largely of cases of neurotrauma, was handled by five main neurosurgeons. Two of them, Dr Kemal Custovic and Dr Nermin Alblizovic still work within the unit in professorship and operative roles respectively. Through the constant shelling, starvation, hopelessness and exhaustion, the neurosurgeons worked tolerantly to save their patients.

In the aftermath of the war, there were severe organizational problems and staff shortages as the department struggled to get back on its feet. The neurosurgical team was drastically reduced in number. The current head of department, Dr Kemal Dizdarevic, took over leadership of the unit during this period of chaos. A young neurosurgeon at that time, he took it upon himself to re-establish the credibility of the department. He realized that the macrosurgical techniques were outdated and needed revision. Under his mentorship, microsurgery, neuroendoscopy and stereotaxy were introduced as the standard operative method. The introduction of microsurgery to the unit spelt a new era in its history. Today, the majority of operative work (eg. aneurysmal clipping, tumour resection, discotomies. etc.) is carried out microsurgically.

The Neurosurgical Intensive Care Unit (NICU) was opened in 2002. It is the first and only intensive care unit dedicated solely to neurosurgical management in the country. With eight beds and sixteen nursing staff (fourteen nurses and two matrons) to provide round the clock monitoring, the opening of this unit has contributed significantly to improving the mortality and morbidity figures. This unit carries out all manner of conservative, perioperative management of neurosurgical patients. Monitoring is carried out on four levels – morphological, clinical, physiological and biochemical. This last method of biochemical monitoring is carried out via a cerebral microdialysis analyzer. The readings obtained allow for better understanding (and hence management) of intrinsic brain biochemistry in cerebral ischaemia. Currently, this is the only neurosurgical department within Southeastern Europe to utilize such technology in perioperative management.

Today, the Department of Neurosurgery is housed in the same building as Emergency Department within the complex of the Sarajevo Clinical Center. It consists of three main divisions – the NICU (discussed above), the High Dependency Unit (HDU) and the general ward. The HDU has a nine-bed capacity whilst the general ward carries thirty-three beds. Currently, specialist services offered include cerebrovascular, skull base, neurooncological, spinal and paediatric neurosurgery. This is the only unit in the country that has the facilities and expertise to carry out aneurysmal clipping. The majority of aneurysmal cases are treated in the acute phase. This move towards prioritizing early surgical intervention was pioneered within Bosnia and Herzegovina by Dr Dizdarevic. Hence, referrals are accepted from all over the country and patients often travel for days to have access to the services offered.

Approximately 750 operations are carried out per year within the unit. The majority of complex neurosurgical cases are referred here. The staff are trained personally by Dr Dizdarevic in such operations and are recognized throughout Bosnia and Hercegovina for their skills. The department has also sought to establish itself within the region by hosting an annual workshop in skull base surgery. This workshop which is currently in its 4th year has been well received by neurosurgeons all over Europe and America.

Noteworthy neurosurgeons who have attended the workshop in the past include Professors Hillman (Sweden), Link (USA), Sterno (Slovakia), Harder (Sweden), Pebo (Sweden), Hernesniemi (Finland), Lehecka (Finland), Winkler (Germany), Ozek (Turkey), Rusnak (Austria), Tulleken (The Netherlands), Cavallo (Italy), Nordstrom (Sweden), Chudy (Croatia). Professor Al-Mefty and Professor Yasargil will be attending the upcoming workshop in September this year. Clinically, morbidity and mortality figures show marked improvement with each year as new strategies for neurosurgical management are explored and developed. The overall mortality in the NICU (where the majority of patients are emergency admissions) is 12%. This mortality rate include considerable number of brain dead patients with intracranial pathology who can be admitted only in our NICU.

There are seven consultant neurosurgeons and three residents. The nursing staff total seventy in number with four matrons on hand to oversee smooth running of the department. The average nurse has at least four years of medical education whilst matrons have a minimum of seven years. There are about twenty-two axillary medical staff.

### 3. Neuroscience and Neurosurgery in Bulgaria

Bulgaria is a country located in southeastern Europe with a territory of 111 square kilometres (16th largest country in Europe) and a population of 7.4 million (21st largest in Europe). Bulgaria is a parliamentary republic, member of the European Union (EU), NATO and the Council of Europe.

Neuroscience in Bulgaria has long traditions and world-wide recognized achievements. Some neuropathies have been recognized clinically and studied at genetic level for the first time in Bulgaria.(2, 3) Our neuroscientists were among the first in Europe to study genetic characteristics in endogamous Gypsy groups in association with neurological pathologies. These tremendous results were achieved by profound field work and establishment of close contacts to the Gypsy community leaders, which was done by the team of Prof. Ivailo Tournev (Department of Neurology, Alexandrovska Hospital, Sofia, Bulgaria).

In neurogenetics, the Bulgarian geneticists are also well recognized by their outstanding publications.(4-9) A number of private mutations were detected in our

patients' groups, showing high genetic heterogeneity of the Bulgarian population. Due to the precise clinical description in clinically ambiguous cases, it became possible to focus genetic tests to particular gene(s) and this way the diagnosis was clarified at molecular level for a number of cases.

Some ongoing clinical trials as for example for transthyretin (TTR)-related familial amyloid polyneuropathy, Niemann-Pick disease, type C1, Pompe disease etc., engaged again our multidisciplinary efforts to find the patients, to clarify their clinical diagnosis, to determine the molecular cause of the disease and to reassure adequate therapy.

The regional neurological and neurosurgical clinics through regional clinical genetics and molecular genetic counselors refer patients for genetic testing to the National Genetic Laboratory, Sofia (for common disease) or to the Genetic Medico-Diagnostic Laboratory "Genica", Sofia (mostly for rare disease). The tight collaboration net between clinicians and geneticists reassures adequate behavior in personalized treatment, family counseling, prevention and prenatal diagnostics.

Nowadays, the multidisciplinary team-work between neurologists, neurosurgeons, clinical and molecular geneticists is the driving force of development of neuroscience in Bulgaria.

The first neurosurgical procedures in Bulgaria were performed in a general surgery clinic in the capital Sofia by Dr N. Vasilev (a student of Cl. Vincent, France) in 1937 and by Dr Ph. Philipov (a student of W. Toennis, Germany) in 1939 (10). The surgeries included mainly patients with trauma and craniocerebral tumours. In 1936, Dr Ph. Philipov and Dr G. Tenchov accomplished the first pneumoencephalography, which is considered as an inauguration of the Bulgarian neuroradiology.

The first Bulgarian neurosurgical manuscript was published in 1941 in the Bulgarian journal "Military-sanitary reflection" and was entitled "On the cranial injuries and their evacuation". This was a review paper, pretending to be an up-to-date comprehensive manual on the treatment of the war-time neurotrauma.

In 1942 was founded the first Bulgarian neurosurgical ward at the Neuro-psychiatric Clinic of University Hospital "Alexandrovska", Medical University of Sofia. The ward was organized and headed by Dr. Ph. Philipov and included two inpatient rooms, one operating theatre and one X-ray cabinet. During the Second World War the whole clinic was transformed to a military neurosurgical hospital with 240 beds, where were treated traumatic brain, spine and peripheral nerves injuries. In 1946 the neurosurgical ward was enlarged in Neurosurgical center.

In 1958 was established the Section of Neurosurgery as a part of the Bulgarian Society of Neurology, Psychiatry and Neurosurgery. The independent Bulgarian Society of Neurosurgery was founded in 1975 and currently is a member of EANS (European Association of Neurosurgical Societies) and WFNS (World Federation of Neurosurgical

Societies).

In 1961 was published the first issue of the journal "Neurology, psychiatry and Neurosurgery" (Sofia) and in 1991-its last volume.

In 1992 was initiated the journal "Bulgarian neurosurgery" as an official journal of the Bulgarian Society of Neurosurgery.

The duration of the neurosurgical residency program in Bulgaria is 5 years and its structure, content and quality is corresponding to this in the other EU countries.

Bulgaria has university neurosurgical clinics in Sofia, Varna, Plovdiv, Stara Zagora and Pleven and military neurosurgical center in Sofia (11, 12). They represent reference centers for their regions. In the last decade, some private hospitals offer various range of neurosurgical services. Currently, the top neurosurgical clinics in Sofia and Varna are equipped with state-of-the-art diagnostic imaging facilities (MRI, multislice helical CT, PET-CT, SPECT, Biplane Angiography System, C-arm), EEG, EMG, SSEP, operating microscopes, neuronavigation systems, neurosurgical micro-instruments, neuroendoscopic systems and instruments, ICP monitors, biochemical, neuropathological and genetic laboratories.

The leading university neurosurgical clinics in Sofia and Varna cover the full range of neurosurgical pathology and procedures. Even without official sub-specialization well developed are neurooncology, vascular neurosurgery, endovascular treatment, spinal neurosurgery, pediatric neurosurgery, functional neurosurgery and partly skull base neurosurgery. Bulgarian neurosurgeons in their daily practice adhere firmly to the World's and European's guidelines and standards of excellence.

Within a period less than a century, our distinguished teachers Prof. Ph. Philipov, Prof. P. Petrov, Prof. L. Karaguiozov, Prof. M. Vanev, Prof. A. Karkesselyan, Prof. V. Bussarsky, Prof. K. Romansky, Prof. St. Gabrovsky and Prof. M. Marinov, by their devotion to the neurosurgical clinical practice, scientific work and education created the Bulgarian Neurosurgical School and put it on the neurosurgical map of Europe and of the world.

The number of the Bulgarian neurosurgeons is about 120. Unfortunately, nowadays exists negative trend for professional emigration of the Bulgarian neurosurgeons to the richer health market of western Europe's countries of the European Union, mainly Germany, UK and France. The problem is getting worse with the time and most probably Bulgaria will face shortage of neurosurgeons within the next decade.

Bulgaria has a national social security system and the neurosurgical treatment of all Bulgarians is covered by this system or by other governmental funds. The neurosurgical grafts for adults however, are not covered by the system and the patients must pay them alone, which sometimes imposes significant problems. Due to the peculiarities of the Bulgarian health system, namely the existence of only one National Health Insurance Fund without any competitors and the model of neurosurgical

service payment by the so called "Clinical Paths", as well as to the global and national economic crisis, the neurosurgical services in Bulgaria are not receiving sufficient funding. Profound reorganization of the health system and of the model of remuneration of the neurosurgical work represents the only possible solution of this problem.

#### 4. Neuroscience and Neurosurgery in Croatia

In the field of Neuroscience the leading position in Croatia holds the Croatian Institute for Brain Research founded in 1990. Its founder and Head, Academician Ivica Kostović has a rewarded career in Neurohistology and Neuroembryology (13). Croatian Institute for Brain Research actively cooperates with some of the greatest names in the field of Neuroscience: Pasko Rakic, Krešimir Krnjević, Tamas Freund, Oleg Krishtal and others. Interactive and interdisciplinary surrounding at the Croatian Institute for Brain Research ensures that the broad spectrum of experimental methods in molecular, cell and behavioral analysis can be applied to every scientific problem.

Among medical specialties, Neurosurgery is by far, one of the most technically advanced. A gigantic step forward has been done from the time of ancient Mayas' preforming skull trepanation with peaked stone to the now-a-days neurosurgeons operating with devices such as neuronavigation or cavitrion ultrasound aspirator.

Croatia has a century long history of performing neurosurgical procedures. In 1927 the famous Croatian otorhinolaryngologist, Professor Ante Šerčer (1896-1968) published a report of surgical treatment on 10 patients with pituitary adenomas (14).

After the World War II, in 1945, Professor Danko Riessner (1907-1973), Head of the Surgical Clinic at the University Hospital Zagreb founded the Neurosurgical ward. Professor Danko Riessner is therefore considered a founder of Neurosurgery in Croatia.

Operating microscope has brought revolution in the field of Neurosurgery. The work of Professor Mahmut Gazi Yasargil became worldwide known. Professor Ivan Jeličić (1929-2012) from Zagreb Medical School has spent a year in Zurich, Switzerland as a Professor Yasargil pupil.

Upon returning to Zagreb, Professor Jeličić had adopted microsurgical technique and is considered the founder of modern microneurosurgery in Croatia. Professor Jeličić together with his colleague Dr. Anto Matković published the first book on Neurosurgery in 1988.

Croatia, as the 28th state of the European Union is trying to follow modern trends in Neurosurgery.

Neurosurgeons in Croatia are capable of performing the whole armamentarium of neurosurgical procedures, including awake brain tumor surgery, functional epilepsy surgery, cerebrovascular surgical and interventional procedures, minimal invasive spine procedures and com-

plex spine surgery. The scientific and publishing work of older colleagues is being continued and a novel book for medical students and neurosurgical residents has been published recently (15).

The International Neuroscience Journal (INJ) is, in our opinion, established to fill the gap between clinicians-neurosurgeons and pure neuroscientists. INJ and its creator, Professor Madjid Samii has recognized the need of close collaboration and critical discussion between neuroscientists and neurosurgeons. We are honored that we can contribute a small puzzle in this historical project of tremendous importance.

## 5. Neurosurgery in Greece

### 5.1. Historical Landmarks

Neurosurgical operations in Greece are as old as the history of Greek civilization. The first, primitive neurosurgical operations were skull trephinations, rather related to religious ceremonies than to medical therapeutic actions (16). The first archeological findings were discovered in Crete and indicate skull trephinations performed for some kind of ceremonial reasons (Bronze Age, Minoan era of Greek civilization, 3000-1050 BC) (17).

Nevertheless, the technical knowledge that was acquired from these “ceremonial” trephinations, was used in the first therapeutic skull operations performed a couple of centuries later. Archeological findings in Mycenae, Peloponnese, clearly show that a craniectomy was successfully performed, in late Bronze Age (Mycenaean civilization 1400-1200 BC) (18, 19).

Ancient Greek Medicine comes to its peak in the “Golden” 5th BC century. Hippocrates (460-377 BC) wrote an essay “About Head Injuries” (“Περὶ τῶν ἐν κεφαλῇ τραυμάτων”), defining the indications for surgical skull fracture repair and describing in detail the surgical trephination tools and techniques (17). He also argued that Epilepsy was not a “Sacred” but a Brain disease (“...ἀλλὰ γὰρ αἴτιος ὁ ἐγκέφαλος τοῦτου Πάθος...” = “...brain is responsible for this affection...”).

In Hellenistic Period (2nd-3rd Century BC), Erasistratus and Herophilus give an impetus in medical knowledge. Erasistratus discriminated the sensitive from the motor nerves (“reinvented” 2000 years later by Bell and Magendie), described the connection between the lateral and third ventricles (foramen of Monro) and he thoroughly studied the anatomy and physiology of cerebellum. Apart from the well-known “torcular Herophili”, Herophilus gave detailed anatomical descriptions of the brain and other parts of the human body (20).

In Roman Period, Galen (in Greek means “calm”) from Pergamon (AD 129-217), expanded and further improved the medical knowledge founded by Hippocrates and developed by Herophilus and Erasistratus, by correcting some of their misunderstandings. He described in detail the head injury surgical treatment. He also proposed peripheral nerve injury repair, using kind of glue derived

from chicken egg.

In Byzantine Period, medicine was further flourished. Paul from Aegina is one of the very prominent Byzantine physicians (AD 7th century) who wrote seven medical books, covering the whole spectrum of medical practice. He described a suturing technique for nerve repair that is similar to the contemporary epineural sewing technique, as it was described by Flourens, Baudens and Heuter, almost 13 centuries later.

### 5.2. Contemporary Period

#### 5.2.1. 19th-mid 20th Century

The first neurosurgical operations were systematically performed in late 19th century, as it was reported in 1877, by a general surgeon, Prof. S Magginas. The same author publishes a General Surgery book, in 1893, where specific chapters are devoted to head injuries, brain tumors, hydrocephalus and spine disorders. In 1894, S. Apostolides publishes a book “Topographic Physiology of Brain Cortex”, where five neurosurgical operations were reported.

In early 20th century, several General Surgeons (Kontoleon E., Mermigkas K., Geroulanos M., Makkas M.) used to perform neurosurgical procedures (21). Two of them, Mermigkas and Makkas, published General Surgery books describing neurosurgical procedures. An ENT physician, N. Taptas, pioneered in trigeminal neuralgia treatment, using injections through foramen ovale (Athens, 1909). Between 1920 and 1940, more sophisticated neurosurgical operations were performed by General Surgeons, most of the time under the supervision of Prof I. Patrikios, a prominent Greek Neurologist who founded, in 1933, the Neurological Clinic at Evangelismos Hospital.

The first Neurosurgical Clinic was established in Athens, in Cancer Hospital Agios Savvas, in 1939. Heliades K. was the Director of this clinic and the first surgeon involved systematically in neurosurgery, trained by Clovis Vincent in France.

#### 5.2.2. Mid-20th Century – Today

After the end of the Second World War and the Greek Civil War that was followed (1949), routine neurosurgical practice starts again. In 1951, Assoc. Prof. Griponisiotis B. is the first Director of the Neurosurgical Clinic in Evangelismos Hospital, in Athens and subsequently, in 1967 he was elected as the first Professor of Neurosurgery in Aristotelian University of Thessaloniki. He founded the first University Neurosurgical Clinic in Greece, in AXEPA Hospital, in Thessaloniki (22).

In 1953, one of the pioneers in Greek neurosurgery, D. Economos, establishes a neurosurgical clinic in Athens Polyclinic Hospital. Dr. Economos was trained neurosurgery in Paris by Vincent, Demartel, Guillome, David and in Canada by Penfield. He was an innovative neurosurgeon and raised the Neurosurgical practice at its highest level. He simultaneously developed all the peripheral

supporting fields of our specialty, like neuroradiology, neurophysiology and neuropathology. He used to perform all pioneer neurosurgical operations at that time and he showed a very high level of expertise. In 1966 the Hellenic Neurosurgical Society was established and he was the first President.

Ten years later, in 1962, another pioneer neurosurgeon, I. Taptas, was appointed Director in AgiosSavvas Neurosurgical Clinic. Apart of being an expert neurosurgeon, he was worldwide recognized as pioneer in cavernous sinus anatomy investigation (23-25). His work on cavernous sinus was the basis VinkoDolenc used to further explore in detail the anatomy and surgery of this complicated neurosurgical area.

Both D. Economos and I. Taptas, established all the principles of modern neurosurgery in Greece and many highly competent Greek Neurosurgeons followed their steps and further developed our specialty in this country.

The same year, 1962, the neurosurgical clinic of General Hospital of Piraeus was established (Chairman Dr. Vato-poulos K.) The following decade many new departments were established. Among them, the first Neurosurgical Clinic in Children's hospital was started in Athens (Head Dr. Komninos S.). In Thessaloniki, Dr. Foroglou G. succeeded Professor Griponisiotis as chairman of the only University Neurosurgical Department at that time, in AXEPA Hospital. Prof. Foroglou was very active in European Neurosurgical affairs within the frame of the European Association of Neurosurgical Societies (EANS). He encouraged many young Greek neurosurgeons to attend the EANS training courses and he worked hard at that time to tighten the connections among European neurosurgeons, including those coming from eastern socialistic European countries.

In eighties and nineties some more neurosurgical departments were established. Prof Papadakis N. started the department of neurosurgery at the local university in Patra, Peloponnese. A couple of new departments were started in peripheral Greek towns like Alexandroupolis, Ioannina, Kavala, Larisa, Herakleion and Chania (Crete).

In eighties, another pioneer neurosurgeon, Dr. D. Rologis, Director of the Athens General Hospital Neurosurgical Department, introduced the surgical microscope in the routine neurosurgical practice. Shortly after him, a prominent neurosurgeon in Thessaloniki, Dr. C. Antoniadis, did the same in northern Greece and ever since micro-neurosurgery became the standard, routine neurosurgical technique, all over the country. Dr. Rologis was and still is a very innovative neurosurgeon, very experienced in vascular neurosurgery and in early nineties he was able to foresee the capacity of the endovascular procedures. He subsequently convinced and supported the author of this article to train interventional neuroradiology techniques. In 1995 the first endovascular procedure was performed in Athens by myself and since 1996 endovascular procedures have been part

of the standard neurosurgical practice in our country. As a consequence, more than 50% of the endovascular surgeons in Greece are active neurosurgeons and our country along with Austria and Holland, are prototype European countries, where many neurosurgeons are actively involved in endovascular procedures. Two of these European Vascular Neurosurgeons (Gruber A. and Andreou A.) are members of both ESMINT and Vascular Committee of EANS.

In 1999, Prof D. Sakas was elected and appointed Chairman and Head of the University Neurosurgical Clinic in Evangelismos Hospital, in Athens. Despite Dr. Karakalos in seventies and early eighties used to perform stereotactic functional procedures in Voula Hospital, Athens, Prof Sakas was introduced in a routine basis and further developed functional neurosurgery in Greece. His work is worldwide recognized and he is Chairman of the Neuromodulation Committee of WFNS since 2007 and President of the European Society of Stereotactic and Functional Neurosurgery (ESSFN) since 2010. Functional procedures are also performed in several neurosurgical departments (Patra, Larisa, Thessaloniki etc.).

In Thessaloniki, Prof Foroglou was succeeded by Prof. K. Polyzoides and Prof. P. Selviarides. Both of them are pioneer neurosurgeons in northern Greece with a great contribution in Greek Neurosurgery. Prof. Polyzoides is Chairman and Head in AXEPA University Clinic and experienced tumor surgeon. Prof. Selviarides continues Prof G Foroglou's activity in EANS affairs and he is national delegate in EANS Training Committee since 2008. He is also President of the EANS Post-Graduate Educational Committee since 2011. He used to be fellow in Mainz (Head Prof. Pernezsky) and he first introduced in Greece the key-hole concept in micro-neurosurgery.

Currently, all contemporary neurosurgical techniques are well developed in the most prominent neurosurgical units, in the country. Functional, vascular, skull base, tumor (including awake craniotomies) and spine surgery, are highly developed in various neurosurgical centers. Nevertheless, most neurosurgical units throughout Greece evolved without the benefit of central planning. The country has witnessed an ever-increasing case load and the dilemma of choosing between a few centralized, well equipped, large centers offering comprehensive specialty training and the need for evenly distributed smaller units, remains unresolved. Moreover, Greek neurosurgeons are proportionally to the population, more than needed and this is an additional problem demanding our attention.

The Hellenic Neurosurgical Society is an active member of EANS and WFNS. Greek Neurosurgeons are actively involved in the activities of both EANS and WFNS and they are meticulously working to host the next EANS Congress in 2016, in Athens (President P. Selviarides). Moreover, there is a vivid interest to develop our relationships with colleagues from our neighbouring countries and therefore we are keen to support all SeENS' activities.

## 6. Neuroscience and Neurosurgery in Moldova

Institute of Neurology and Neurosurgery operates according to the Government Decision no. 1326 of 14 December 2005 "On measures for optimizing the infrastructure of science and innovation" by decision of MH no. 15 -p § 3 of 01.02.2006 "On the change of name of medical institutions under the Ministry of Health" as a predecessor of Public medical institution, The Scientific and Practical Center of Neurology and Neurosurgery, is registered through state Registration Chamber decision of Ministry of Information Development of RM no. 1003600150602 of 02.06.2006 and accredited according to the Decision of the National Council for Accreditation and Attestation no. 49/AC October 30, 2008 "On the assessment and accreditation of the Institute of Neurology and Neurosurgery".

INN is the only curative- preventive specialized institution, which provides highly skilled nursing inpatient and outpatient stage patients with diseases of the nervous system, is the scientific basis intended for scientific investigations, development and practical implementation of the latest scientific and clinical basis in practice by USMF "N. Testemițanu"s staff and the College of Medicine's staff.

INN provides highly skilled nursing inpatient and outpatient services

## 7. Neurosurgery in Macedonia

The beginnings of the neurosurgery in Macedonia is connected with the foundation of the Medical faculty in Skopje-Macedonia in 1947. The first cranial trepanations in compressive traumatic haematomas were performed by a general surgeons. The very first neurosurgical instrumentarium was supplied in 1952.

Neurosurgical department as a part of the Surgical clinic in Skopje is established on October 3rd, 1958.

First chief of the neurosurgical department is Prof. drPetarTofovic, who with assistance of Prof. drDragojevic – the head of all surgery departments, was leading the department. After that the department joined two more specialists-neurosurgeons: Prof. drPetarRuskov and Prof. drMirkoMircevski.

During the 70's, operative treatments from the general neurosurgery are becoming a routine. First CT scan is obtained in 1978. First micro neurosurgical intervention is performed in 1982. At the same year Department became a Neurosurgical Clinic. At that time six neurosurgery specialist were part of the Clinic and routine neurosurgical interventions were performed at daily basis.

Since 2001 neurosurgical clinic has two operating theaters, its own neurointensive care, and neurosurgical ward consisting of 45 beds.

First operative neurosurgical microscope is obtained in 1995 and CUSA in 2001. New microscope Pentero and neuroendoscope, and possibility of navigation and evoked

potential were obtained in 2010.

Nowadays, at the neurosurgical clinic, we operate on all pathological processes in the area of neurosurgery. Until now, directors of the Clinic were Prof. PetarTofovic (1958-81), Prof. JovicaUgrinovski (1981-89), Prof. MirkoMircevski (1989-95), Prof. IlijaPangovski (1995-2002) Prof. SpaseJovkovski (2002-05), Prof. KirilLozance (2005-06) and Prof. AleksandarCaparoski (2006- present).

We treat 1500 patients per year, of which approximately 1000 are operated on (200 tumors, 170 cerebrovascular cases, 200 degenerative cases of the vertebral column, 100 hydrocephalus, 100 craniocerebral trauma, 60 congenital malformation, 30 peripheral nerves, and other).

In Republic of Macedonia there are 24 neurosurgeons, of which 9 are employed by the neurosurgical clinic, part of medical University St. Cyril and Methodius, Skopje, city hospital- Skopje has 2, Clinical hospital Tetovo has 3, Clinical Hospital Bitola has 2, Clinical Hospital Stip has 1, and city Hospital in Ohrid has 1 neurosurgeon and 4 neurosurgeons are employed in the private hospitals.

Neurosurgery Clinic is affiliated with the Medical Faculty in Skopje. Until now there are 10 neurosurgeons with PhD thesis and 3 with master thesis. Publishing activities include 12 books of neurosurgery and numerous papers published in scientific journals. Also, Macedonian neurosurgeons actively attend neurosurgery congresses and symposia around the world with published papers.

Macedonian Society of Neurosurgeons is active member of EANS, WFNS and SEENS.

## 8. Neurosurgery and Neuroscience in Romania

The history of Romanian Neuroscience and Neurosurgery is deeply connected with the one of Western Europe. Modern Romania has been established in the territory it occupies nowadays by the Great Union in 1918, after the First World War. It was formed through the union of The Romanian Country (previously formed in 1859 by the union of the Principalities of Moldavia and Walachia) and Transylvania. The beginnings of modern medicine in Moldavia and Walachia were greatly influenced by the medical school of France, since the large majority of the founders of this medical school graduated in Paris and Montpellier. In Transylvania, at that time part of Austro-Hungarian Empire, the medical school was influenced by the schools of Vienna and Budapest.

The beginning of Romanian neurosurgery is related, as in other parts of Europe, to the activity of some brave and also visionary surgeons. We consider it a duty of honor to present a brief summary of the activity of the most important personalities, who greatly influenced the development of neuroscience and neurosurgery not only on Romanian territory but also in Europe.

## 9. The Pioneers of Neurosurgery

LUDOVIC RUSS-SENIOR (1816-1888) native from Austria, graduated the medical school in Vienna, and moved to

Iasi in 1844 at the "Sf. Spiridon" Hospital, where he would conduct the department of general surgery for 44 years. In Iasi, 1847, he performed the first Romanian mentioned trepanation for a clinically diagnosed extradural hematoma. In the same year, he performed the first operation with ether anesthesia, some months after the first public demonstration of painless surgery using sulfuric ether made by John Collins Warren and William T.G. Morton. Ludovic Russ-Senior also has the merit of being the first to present the "Skull Anatomy for trephination" in his general surgery course, edited in 1863.

NICOLAE TURNESCU (1818-1890) graduated medicine in Paris, and became professor of surgery at the Bucharest Faculty of Medicine. In 1856 he published (in "Buletinul Oficial" Nr.89/1856) the first successful surgical treatment for hydrocephalus in Romania, consisting in an external ventricular drainage associated with iodine injections. This was the second ventricular puncture mentioned in literature, after those performed by Dr. Vrenard, President of Medical College from Chicago, Illinois, in 1854.

From a historical point of view, based on the literature that we have had access to, the starting point of Romanian Neurosurgery could be placed between 1890 and 1900, thanks to three great surgeons and their constant interest in a new and developing surgical field.

ANASTASIEVICI LEONTE (1853-1914), graduated the Faculty of Medicine in Bucharest in 1875 and is the first Romanian surgeon who constantly approached neurosurgical pathology according to the modern principles of asepsis and antisepsis, chloroform general anesthesia, Chapionniere's cranial topography and neurological presentation. Between 1886 and 1891 he performed 22 "trephinations" (craniectomies) for different pathologies including severe trauma, neglected skull fractures, epilepsy and spontaneous intracerebral hemorrhage. Along with N. Bardescu, he summarized all these cases in the article "Intervention chirurgicale dans les affection cerebrales" published in the in *Revue de Chirurgie* [vol IX, Octobre 1891, p.813, Paris], this being considered the first Romanian systematic approach on the role of surgery in cerebral pathology. According to the Romanian literature, A. Leonte performed the first successful removal of an Epidural Hematoma on the 11th of July 1888, the first sagittal sinus suture on the 11th of Dec. 1888 (in literature this feat is attributed to Henri Duret), the first removal of a spontaneous intracerebral hematoma in Oct. 1890 (this seems to be the second case in European literature after the case presented by Championniere). In the same year, 1890, he performed the first "trephination" (in fact a decompressive craniectomy) for idiopathic epilepsy.

GEORGE ASSAKY (1855-1899, began his medical studies in Montpellier and continued in Paris. In 1886 he presented his PhD thesis entitled "De la suture des nerfs a distances", highly appreciated by the Academy of Medicine in Paris. Because of this work, he is considered one of the pioneers of the peripheral nerves surgery in Europe, and also one of the promoters of experimental surgery. Due to his in-

terest in craniocerebral topography, he is considered one of the promoters of Romanian neurosurgery.

NICOLAE BARDESCU (1862-1937), graduated in Bucharest. His mentors, Prof. Anastasievici Leonte and George Assaky significantly influenced his surgical career. The PhD thesis entitled "Contributions to the study of cranial trephination" represents only the beginning of a prodigious activity in the field of neurosurgery. Up to 1906 he published 111 scientific papers regarding cranial injury, spine and spinal cord injury, complications of the head injury, cranioplasty, surgical treatment of trigeminal neuralgia. In 1894 he performed the first surgical removal of an intracranial tumor noted in the Romanian literature: "Cerebral sarcoma. Jacksonian Epilepsy". Reviewing the existent publications, Bardescu specified that up to his intervention, in literature there were 28 published cases of operated brain tumors, with a mortality of 46.5%. In 1895 Nicolae Bardescu was the first to perform a resection of Gasser's ganglia for trigeminal neuralgia.

THOMA IONESCU (1860-1926), graduated medicine in Paris, where he also sustained his PhD thesis in 1892. At the age of 35, as a professor of Anatomy in Paris, he accepted to become professor of Topographical Anatomy at the Faculty of Medicine in Bucharest, and also Professor of surgery at the Coltea hospital. Considered the founder of modern surgery in Romania, his interest in the field of neurosurgery was based on a continuous effort of documentation and personal experience. His major interest was the surgical treatment of epilepsy, where he advocated for sectorial corticectomy (1887), no deeper than one centimeter. Continuing the development of surgery in epilepsy he favored the Doyen's technique of temporal craniectomy, but more than that, he introduced a new method of osteoplastic craniotomy. In 1897 he argued for the necessity of dural opening in temporal craniectomy in order to prevent the devastating consequences of brain edema (one year before Jaboulay, who was credited by Harvey Cushing with this idea). In search for a better solution, Thomalonescu proposed and performed cervical bilateral sympathectomy for epilepsy, based on the presumption that the pathogenic role of cerebral flow changes in this pathology. This idea made logic, since in nowadays Vagal Nerve Stimulation (VNS) is method of choice in epilepsy. Along with his interest in epilepsy, Thomalonescu introduced the Krönlein technique in our country, for lateral approach of the orbit, operating 5 patients at the time when only 17 cases were reported in the literature. He also introduced and demonstrated the Cervical Spinal Anesthesia, during his visits in the USA and the United Kingdom.

AMZA JIANU (1881-1962), graduated Medicine in Bucharest, former student of Thomalonescu, he became the closest collaborator of this great surgeon. At the age of 31 he was promoted Professor of surgery in Iasi. In 1910 he published an original paper on decompressive craniectomy ("Decompresivcraniectomie" *Dtsch. Z. Chir.*, 1910, vol. 107). He was the first Romanian surgeon who suc-

cessfully removed an acoustic neuroma (case published along with Bacaloglu in *Rev. de Med.* 1914-1915, XXXIV, 760-775, and cited by Harvey Cushing in his "Tumors of the Nervus Acusticus" from 1917). The interest in the field of neurosurgery is also demonstrated by the attention he gave to surgical treatment of trigeminal neuralgia, spinal cord pathology (he performed 12 laminectomies for previously diagnosed cases with Lipiodol), introducing an original procedure for surgical treatment of facial paralysis "Sternocleidomastoidian myoplasty- Lexer-Jianu technique". In 1931 he successfully removed the first suprasellar tumor in Romania. He also encouraged A. Moruzzi, D. Bagdasar and Dem. O. Vasiliu toward the newly developed specialty - Neurosurgery.

## 10. The School of Neurology

At the turn of the centuries, Neurology became an individual specialty in our country. The first physician who dedicated his activity to this new developing medical field was GHEORGHE MARINESCU (1864-1938), graduated medicine in Bucharest, he specialized in neurology in Paris, at Salpêtrière Hospital, under the patronage of Professor Charcot, working along with Pierre Marie, P. Blocq and Gilles de la Tourette. Between 1889 and 1897 he alternatively worked in Paris, Frankfurt, Berlin, being highly interested in the pathology of nervous system. There are some very valuable studies dating from this period, like pathological changes in acromegaly (along with P. Marie), medullary center of breathing (with J. Gad), a pathological atlas of neurological disorders (with P. Blocq). In 1898, along with cameraman C. M. Popescu, he produced the first medical video in the world: "The walking changes in organic hemiplegia". His researches in the pathology of nervous system were published in 1909 in Paris as a monography entitled "La cellule nerveuse" (The nervous cell), prefaced by Ramon y Cajal. Due to his prodigious activity, Gheorghe Marinescu is considered not only the first Romanian neurologist, but also the most important one.

In the same period, In Transylvania, at that time part of Austrian-Hungarian Empire, the foundation of a Faculty of Medicine in the new established Franz Josef University (1872) from Cluj (Kolozsvár/Klausenburg) represented the start point of a systematic educational and research activity in this region. From a neuroscientific point of view, some personalities must be mentioned: ENDRE HÓGYES (1847-1906), professor of Pharmacology, was especially interested in the connection between the equalization of the ocular muscle with the labyrinth (vestibule reflex 10), thus achieving notorious discoveries in the field as early as the beginning of the 1880's. KÁROLY LECHNER (1850-1922) professor of Psychiatry and Neurology was remarked for the research he conducted in the pathology of reflexes, dealing with hallucinations and the issue of consciousness. He was one of those who, for the first time, proved the continuity of acquired reflexes.

Founder of an actual school of Neurology, GHEORGHE MARINESCU's activity was continued by other great researchers in this field of neuroscience, their contribution to the development of the specialty in Romania and in Europe being of outmost importance. From the gallery of his followers we have to mention: ANGHEL RADOVICI (1885-1956) former assistant and collaborator of Prof. Marinescu, along whom he described the "palmo-mentonier reflex". He also authored the monograph "La syphilis nerveuse" (1928). NICOLAE IONESCU-SISESTI, specialized in Neurology with Georges Guillain in Paris, he became the closest collaborator of Gheorghe Marinescu in Bucharest, and also his successor. His work in the field of neurology was focused on spinal cord tumors and brainstem physiology, authoring two important monographs: "Tumeurs médullaires associées à un processus syringomyélique" (1929), and "La Syringobulbie - contribution à la physiopathologie du tronc cérébral" (1932). CONSTATIN I. PARHON (1879-1965), graduated in Bucharest, in 1900 he sustain his PhD thesis entitled "Contribution to the vascular motility in hemiplegia". In 1909 published, along with M. Goldstein, "Les sécrétions internes", considered the first textbook of endocrinology. His fruitful collaboration with Amza Jianu, and also of his successor Leon Baliff with surgeon Alexandru Moruzzi, created the premises for the establishment of the first Neurosurgical Unit in Romania in Iasi, in 1933, this unit being also the third independent Neurosurgical Service in Europe, after Professor H. Olivecrona's clinic in Stockholm and the Neurosurgical Clinic at the Military Hospital in Sankt Petersburg.

## 11. The Founders of Neurosurgery

Alexandru Moruzzi (1900-1957) the founder of the first Neurosurgical service in Romania graduated Medicine in Paris and trained in neurosurgery, in the service of Prof. Thierry de Martel (during 1929-1930). The Service of Neurosurgery was established in the Socola Hospital on the 1st of January 1933. After 18 months of intense neurosurgical activity, he published the first paper encompassing his experience in spinal cord tumors, along with Prof. Baliff and M. Ferdman: 13 cases of spinal cord tumoral compression. Between 1934 and 1941, when Romania engaged in the World War II, he performed 329 neurosurgical interventions. After the end of the WWII, in 1947, he emigrated in Venezuela and after that in United States.

One year after the establishment of Neurosurgical services in Iasi, in November 1934, in Bucharest, 2 neurosurgical services were founded. The first one within the Bucharest Central Hospital headed by Dr. Dumitru Bagdasar, and the second one in Witting Hospital headed by Dr. Dem. O. Vasiliu.

Dumitru Bagdasar (1893-1947) began his career as neurologist, at the Colentina Hospital in Bucharest, in the Clinic directed by Prof. Dr. Gheorghe Marinescu. His formation as a neurosurgeon was coached by H. Cushing, at Boston (1927-1929). As Cushing did in the US, Bagdasar turned

neurosurgery from butchery to brilliance. Between 1931 and 1941 he performed 1800 surgical interventions. Despite the fact that at the beginning the neurosurgical services have had only 8 beds, through his activity he progressively developed his service and surgical performances. His original contributions in neurosurgery have materialized in numerous scientific publications in domains like posterior cordotomy, cerebral tuberculosis, spinal cord tumors. In 1941, D. Bagdasar, State Draganescu and ConstantinArseni performed an original surgical treatment in craniostenosis. DumitruBagdasar became the first Professor of Neurosurgery in Romania in 1946. Unfortunately, he died too early, in 1947, at the age of 54 years.

Dem O. Vasiliu was a personality unfairly neglected by the official history of Romanian neurosurgery. Trained in neurosurgery by H. Cushing, C. Frazier, C. Elsberg and W. Dandy for a period of two and a half years, he introduced the PEG in Romania in the diagnosis of brain tumors, and also performed the first lobectomy for invasive gliomas. He developed a special interest in clinical and surgical aspects of congenital arachnoid cysts. He strongly advocated for a systematic development of neurosurgery as an individual specialty.

Between 1941 and 1944, for a period of almost four years, part of Transylvania, including Cluj/Kolozsvár, was annexed to Hungary. In that period prof. KÖRNYEY ISTVAN, the founder of Hungarian neurosurgery and already a famous European neurosurgeon moved to Cluj in order to organize a neurosurgical service in Cluj/Kolozsvár in 1941.

## 12. The Continuators

NICOLAE OBLU (1912-1995) Became head of the Neurosurgical Unit at the Socola Hospital in Iasi in 1951. In 1964 this unit was transformed into a neurosurgical clinic, and also became a center of postgraduate courses. Prof. N. Oblu has the great merit of establishing the first Neurosurgical Hospital in Romania, in 1972, as a result of his tremendous effort and perseverance.

CONSTANTIN ARSENI (1912-1994) graduated Medicine in Cluj in 1935, between 1936 and 1946 he worked in the Neurosurgical Unit of Prof. D. Bagdasar. In 1946, after the disappearance of Prof. Bagdasar, Arseni, at the age of 34, became the head of the Neurosurgical Dept. Due to his efforts and political influence, in 1975, the largest Neurosurgical hospital in the world, at least for that time, was opened, having 650 beds and 19 operating theaters. Because of his tremendous work (more than 32.200 surgeries and 54 monographs) he is considered the founder of contemporary neurosurgery.

SOFIA IONESCU-OGREZEANU (1920-2008) was the first woman neurosurgeon in the world. Her priority was recognized in 2005 at the WFNS Congress in Marrakesh. She started her work in the neurosurgical field in 1943, under the guidance of D. Bagdasar, then she became member of the team directed by C. Arseni. Her major fields of activity were brain tumors and spinal degenerative pathology.

## 13. The Developers

STEFAN TRISTAN IACOB (1920-1976), graduated the Faculty of Medicine in Bucharest at the Medical-Military Institute in the period of 1939-1945. After a period of training in neurology, he completed his formation in neurosurgery under the supervision of D. Bagdasar and C. Arseni (1946-1949). In 1949 he was transferred to Cluj, establishing the neurosurgical department in the same building where Prof. Kornyei previously worked. His scientific work was impressive, more than 280 papers and 4 monographs alone or in collaboration (Neuropathology of the war-1943, vertebral sciatica along with C. Arseni). As a founder of the neurosurgical school in Cluj, he highly contributed to the formation of great neurosurgeons, the most worldwide known being Prof. Ladislau Steiner.

LEON DANAILA trained in neurosurgery under the guidance of Prof. Arseni together with whom he worked for 20 years. In 1981 he established the Vascular Neurosurgical Department. What professor Yasargil made for World Neurosurgery, prof. Danaila made for Romanian Neurosurgery. In 2011 he reported 21.700 microsurgical interventions and 2760 operated intracranial aneurisms representing probably one of the largest series in the world.

AlexandruConstantinovici, was head of Neurosurgical Hospital in Bucharest between 1990 and 1998, former President of the Romanian Society of Neurosurgery. He largely contributed to the development of international cooperation of Romanian neurosurgery. He promoted the transsphenoidal surgery in Romania. Under his presidency, the scientific meetings of RSN became international, and English became the official language of RSN's Conferences and Congresses. In order to develop regional collaborations, he initiated together with Prof. Ciurea, the Black Sea Congress in 1999.

ALEXANDRU VLAD CIUREA was specialized in Neurosurgery under coordination of Prof. C. Arseni. In 1974 he sustained his PhD thesis entitled "Actual therapeutic aspects of pituitary adenomas". In 1997 he became Professor of Neurosurgery and in 1999 President of RSN up to 2008. His activity was internationally recognized, being the Vice-president at large of WFNS between 2005 and 2009, and Chairman of the Nominating Committee of WFNS from 2009. An outstanding neurosurgical personality, he decisively contributed in the Romanian neurosurgery progress and worldwide knowledge. During his activity he achieved more than 20.000 surgeries, 27 monographs as a first author and other 21 monographs as a co-author, being also the main author of more than 180 published papers (26-28).

## 14. Neuroscience and Neurosurgery in Serbia

### 14.1. Neuroscience in Serbia

Ever since the 1950's a significant number of well-established researchers and academicians have been involved

in neuroscience in Serbia. The quality of their work and results has always been visible through numerous, highly cited publications. The best proof of continuous raising interest in the field of neuroscience in Serbia over the years is the fact that currently approximately 15% of all researchers in the field of Biology, Biomedicine and Medicine are actually in the field of neuroscience. Furthermore, up to date faculty programs in Neuroscience have been introduced and students' neuroscience section under auspices of Serbian Neuroscience Society, has gathered both undergraduate and postgraduate students of medicine, biology, philosophy, defectology and many other around the idea on the multidisciplinary approach to neuroscience. At the same time, a lot has been done on increasing awareness of the general public about the importance of neuroscience research in Serbia and on promotion and visibility of Serbian researchers and their results. In this line, attempts have been made in establishing cooperation both within European Research area and with other international scientific institutions. It is clear that strategy for neuroscience in Serbia exists and that, despite all difficulties, there are people who are eager to prolong the long tradition of neuroscience in Serbia.

Neuroscience has a long tradition in Serbia since the beginning of the 20th century. Nowadays 16% of researchers in biology and medicine area, and 3-4% of total 13 760 researchers in Serbia, are in neuroscience. We are going to mention the greatest neurologists and neuroscientists, who deserved with their lifetime achievement that some hospitals, institutes, and even streets bear their name.

Laza K. Lazarević (1851-1891) was a Serbian doctor, writer and warrior. After completing his law studies in Belgrade in 1871 he made his way to Berlin and graduated from the Faculty of Medicine in Berlin and received his doctor's degree in 1879 at the same Faculty. He participated as a field doctor in the Serbo-Turkish War in 1876 and 1878, as well as in Serbo-Bulgarian War in 1885. During the Serbo-Bulgarian War (1885) he was given the rank of active medical colonel and was appointed as an assistant chief of the Supreme Command of Health Care with the task to establish the Great reserve military hospital in Niš. After graduating he was appointed as the Head of the Internal Department of the General State Hospital. Laza Lazarević's contribution to Serbian medicine is enormous: he was the founder of laboratory diagnostics in Serbian medicine and he established the first modern geriatric hospital this part of Europe. During his short professional carrier he managed to publish as many as 78 papers and observations, a great number of which refers to the disease of the nervous system. He published the first description of the Parkinson's disease in this region, and scientific papers about sclerosis of medulla spinalis, aphasia, muscular dystrophy, brain tumors and arsenic in treatment of chorea. The best known contribution of Laza K. Lazarević was his paper published in Serbian Archives in 1880 where he described a sign that is today called after him - the

"Lazarević sign". Therefore, it can be rightly said that Dr. Laza K. Lazarević was the first Serbian neurologist. Laza K. Lazarević is considered to be the progenitor of Serbian realistic psychological story. He published nine stories and in 1888 became a member of the Serbian Royal Academy. Clinic for psychiatric disease in Belgrade is named upon Laza K. Lazarevic.

Richard Burian (1871, Vienna-1954) founded the Institute of Physiology and Histology in Belgrade in 1927. Although he came to Yugoslavia at the invitation of the School of Medicine in Ljubljana (today Slovenia), and though a full Professor of different disciplines at Vienna, Innsbruck, Hannover and Leipzig, it was not until 1920 that he was made, at the insistence of Professor Milan Jovanovic-Batut, a full Professor of Physiology at the newly founded School of Medicine in Belgrade. During the winter of 1922/1923, at the School of Medicine in Belgrade, Richard Burian started with his lectures in German. However, after two years, he gave all his lectures in the Serbian language.

Between 1923 and 1934 he was Dean and Vice Dean of the Faculty of Medicine. He also campaigned for the establishment of the Faculty of Veterinary Medicine (1936) and Faculty of Pharmacy (1939). The personality of Richard Burian, together with his reputation in science, and authority as a professor, attracted numerous associates not only at the Institute of Physiology in Belgrade, but also with other Professors of Physiology within Belgrade (the School of Veterinary Medicine, the School of Pharmacy and the School of Agriculture). He also collaborated well with other schools of medicine in former Yugoslavia: Professors Milutin Neskovic, Ilija Djuricic and Bozidar Nikolic in Belgrade, Aleksandar Sabovljic in Sarajevo, Radmilo-Anastasijevic in Novi Sad, and Aleksandra Volkanoska in Skopje.

In the first few years, within the Institute of Physiology (today - the Institute of Medical Physiology), scientific research was progressing in several departments. These included Physico-Chemistry, Chemical Physiology, Microchemistry, Electrophysiology (which contained facilities for photographic recording), graphics working with the operating theatres.

The focus of his experimental work were: metabolism of purines, methodology for the study of the nerves and muscles of mollusks, contraction of injured muscles, function of neuromuscular synapses, function of biological membranes and physiology of swallowing.

Professor Richard Burian was a recipient of several medals and honors: the Order of the Romanian Crown of 3rd class (in 1931), the Order of Saint Sava of 2nd class (in 1934) and the Order of the Yugoslav Crown of 2nd class (in 1936). In memory and respect of the founder and first director, the Institute of Medical Physiology of the School of Medicine bears his name. At the suggestion of the School of Medicine in Belgrade, one street in Belgrade bears the name of the physiologist Professor Richard Burian.

Ljubodrag Mihailovic (1926-1974) was one of the greatest

researchers in the area of neurophysiology and neuro-pathophysiology in the middle of the 20th century and he published 120 articles during 20 years of active research. The first group of articles were related to the biophysical and biochemical properties of neurons and their membrane. He was the first scientist in Yugoslavia that registered electrical phenomena in the neurons by intracellularly placed electrodes. This method allowed him to confirm that sodium influx is responsible for the genesis of action potential in leech *Retzius* cells, and that oxidative metabolism is required for the maintenance of low resistance between electrotonically coupled cells.

Ljubodrag Mihailovic was the first scientist in Yugoslavia that used molecular techniques in the investigation of the physiological processes in the brain and pathogenesis of neurologic disorders. He with his collaborators determined RNA quantity in inferior temporal gyrus and frontal cortex of monkeys that learned visual discrimination test. Since RNA codes the protein synthesis, he continued with determination of the role of proteins in learning and changes in protein levels after electroshock. These studies found that the amount of acidic proteins was increased in combination with RNA in inferior temporal gyrus in monkeys that performed visual discrimination test, and decreased after electroshock during period of amnesia. This contributed significantly to the understanding of the cellular mechanisms of learning.

The special area of research of Ljubodrag Mihailovic was the investigation of pathogenetic mechanisms of seizures and epilepsy. A great part of his career was devoted to the investigation of electrical activity of neocortical, allocortical and subcortical structures in seizures induced by electroshocks, and to the mechanisms of neuronal synchronization in focal seizures with secondary generalization. In various experimental models in cats and monkeys he studied the effects of anticonvulsive drugs. Ljubodrag Mihailovic introduced immunoneurophysiological approach in the research of immunological phenomena in experimental allergic encephalomyelitis, as well as of the role of various macromolecules in the learning and memory consolidation. Through the power of his personality and his personal involvement he established and developed conditions for research, formed scientific staff in the field of pathophysiology, neurophysiology and especially neuropathophysiology at the Institute of Pathophysiology, Faculty of Medicine in Belgrade, which in his honor carries the name of Ljubodrag Buba Mihailović.

The founder of physiology studies in the Balkans and the pioneer of research on hypothermia, Ivan Djajaw was born 1884 in L'Havre. Djaja gained his PhD at the Sorbonne in 1909. In 1910 he established the first Chair of Physiology in the Balkans and organized the first Serbian Institute for Physiology at the School of Philosophy of the University of Belgrade. His most notable papers were in the field of thermoregulation and bioenergetics. Djaja became member of the Serbian and Croatian academies of science and doctor honoris causa of Sorbonne. In 1952

for the seminal work on the behavior of deep cooled warm blooded animals he became associate member of the National Medical Academy in Paris. In 1955 the French Academy of Sciences elected him as associate member in place of deceased Sir Alexander Fleming. Djaja died in 1957 during a congress held in his honor. He left more than 200 scientific and other papers and the golden Davincian credo "Nulla dies sine experimento".

Radoslav K. Andjus (1926-2003) was a professor of physiology and biophysics at the University of Belgrade, Serbia, from 1953 to 1992. He published over 190 papers in domestic and international journals and three textbooks. The main field of his research was thermophysiology. He studied hypothermia, suspended animation and resuscitation, hibernation and biological rhythms, temperature adaptation and acclimation, and cryoprotection. Radoslav Andjus also contributed significantly to the fields of brain metabolism, electroretinography, as well as biophysical modeling and theoretical biology.

Professor Lević M. Zvonimir (1936 – 2009) was the dominant personality of the Yugoslav neurology from the early 80s until his retirement in 2001.

He becomes director of the Neurological Clinic in 1984, soon after the separation of neurology and psychiatry from formerly joint discipline neuropsychiatry. In the coming years neurology was rapidly developing and modern methods of examination of neurological diseases were introduced. Large number of young talented doctors was employed and close contacts were made with great neurological centers such as the Karolinska Institute in Stockholm, Hospital for Neurology Queen Square London, New York Columbia University, Baylor College of Medicine Houston and numerous European clinics. Under leadership of Prof. Levic, scientific-research teams were quickly achieve an international reputation (team for demyelinating diseases, epilepsy, extrapyramidal and involuntary disorders, neuromuscular diseases and neuropsychology).

Prof. Levic participated in the founding and development of the subject of neurology at the Medical Faculty in Kragujevac, founded and conducted classes in sub-specialization in Clinical Neurophysiology with epileptology. As head of the Department of Neuropsychiatry (1990) and later Neurology (1991) participated in the creation of programs and teaching all forms of undergraduate and postgraduate studies in neurology. Through his books, articles, lectures and mentoring, significantly influenced the development of neurology as independent discipline and profession in our country.

Main field of interest of Professor Levic particularly were problems of multiple sclerosis and epilepsy. He has participated and led several international and national research projects. He was a member of 11 scientific committees and boards of various societies worldwide. Professor Levic published 350 scientific and research papers, of which 108 in international journals (42 in extenso and 66 abstracts). He was a visiting lecturer at the Universi-

ties of Innsbruck, Salzburg, Vienna, Szczecin, Rostock, Moscow and Houston. Awarded by the Serbian Medical Society Award for Lifetime Achievement in 1997.

Professor Zvonimir Lević was a great teacher who led and educated many generations of neurologists. His students have been highly appreciated by his intuition, experience, rationalism and thoughtful attitude in performing clinical findings and diagnosis. His patients were grateful for his expertise unpainted number of times.

Professor Lević was a great gentleman of Serbian and Yugoslav neurology who paved the way for modern Serbian neurology 21st century.

On the heritage of these famous neuroscientists, a large number of members of Serbian Academy of Science and Art were or are actually devoted to neuroscience with great success. Among them were/are Bogomir Mrsulja (1940-1994), Bogdan Djuricic (1950-2008), Ljubisa Rakic, Veselinka Susic, Vladimir Kostic.

This paper was prepared by the members of the Laboratory for Neurophysiology, Institute of Medical Physiology "Richard Burian", Faculty of Medicine, University of Belgrade: Olivera Stanojlovic, Aleksandra Rasic-Markovic, Dragan Hrnčić, Dusan Mladenovic, Bojana Petrovic.

#### 14.2. Neurosurgery in Serbia

The beginnings of neurosurgery in Serbia reach back to the year 1914, when Professor Milivoje Kostić performed a series of neurosurgical procedures mainly on the peripheral nervous system and in the extradural space. The period is considered a heroic era of neurosurgery, since this discipline was in its infancy all over the world. It was in 1923 when he had performed the first surgical treatment of a pituitary tumor, using transsphenoidal approach. Only 13 years after 1910, when the first cranial x-ray was made, Milivoje Kostić began to pursue nervous system surgery. Since he operated in aseptic conditions, he freely opened the skull and entered the intradural space.

Since he worked in the Military Hospital in Sarajevo during the First World War, he was experienced in treatment of the nervous system trauma.

He noticed the difference between contaminated and infected wounds and realized that the infected wounds could be successfully closed by a primary suture. This fact was considered to be a fundamental contribution by Harvey Cushing to neurological science of this time, since Cushing, contrary to Milivoje Kostić published this observation in the British Journal of Surgery (1918).

In the year 1940 Slobodan Kostić, Milivoje's younger brother implemented new diagnostic technique, x-ray imaging of air in the ventricular system, ventriculography to improve localization of the intracranial lesion. At that time, even at the best neurological clinics brain tumors could not be precisely localized in more than 50% of the cases. However, ventriculography introduced by Slobodan Kostić in 1940 could indicate the site of the lesion precisely in 80% of the cases.

Only eight years after the sensational report by Egaz

Moniz for Almeida Lima in 1931 at the Congress of Neurology in Bern, Slobodan Kostić introduced cerebral angiography in Belgrade.

On October 31st 1938 Milivoje Kostić opened a Department of Neurosurgery within The First University Surgical Hospital in Belgrade, which was the first of its kind in Yugoslavia, and only three years after the first neurosurgical department had been opened in Germany, in Wurzburg.

During the war, both Milivoje and Slobodan Kostić worked as surgeons in the Military Hospital, and they both supervised surgical management of craniocerebral injuries. In the course of the war, waste experience was gained in management of penetrating and non-penetrating cerebral injuries. After the war, owing to great efforts of Professor Slobodan Kostić, in 1951 when a reorganization of surgical clinic took place, the Neurosurgical clinic was opened as an independent institution both in the organizational, financial and professional aspects.

At the beginning of 1960 the first stereotaxic thalamotomy was performed in Belgrade and Yugoslavia. Functional neurosurgery has been developing ever since and found its rightful place at the Neurosurgical Clinic.

Neurosurgical treatment of congenital anomalies, hydrocephalus above all, has always been one of the problems the Neurosurgical Clinic had to deal with intensively. In early sixties, the first surgical treatment of hydrocephalus was performed implanting the shunt and one-way valve. Pediatric neurosurgery has also always been one of important segments of neurosurgery in Belgrade, which has led to opening of the Department of Pediatric Neurosurgery which is the only one in the country even nowadays.

The Clinic for Neurosurgery at Clinical Center of Serbia is one of the largest European institutions of its kind. The department has 160 patient beds. There are over 4000 admissions to the Neurosurgical Service each year, 3500 surgeries, and 15 000 emergency or outpatient consultations. There is a strong emphasis on undergraduate and postgraduate teaching as well as clinical research. Despite economical problems and the huge sociopolitical changes that have devastated Serbia during the last 3 decades, the department keeps growing with an optimistic outlook thanks to the joint efforts made daily by each member of the team.

Clinic for Neurosurgery in Belgrade is a highly specialized health, scientific and educational institution which is a part of the Faculty of Medicine, University of Belgrade and also a referral center for all neurosurgical centers in Serbia, especially for peripheral nerve and brachial plexus surgery within the region.

The Clinic for neurosurgery is organized into sections, each one dealing with clinical investigations and surgical management of patients as well as postoperative treatment and referral to the ancillary services needed to establish final diagnosis, such as neuroradiology, neuroophthalmology, and biochemistry. The Neurooncologi-

cal Center is the largest one in Serbia, treating primary and metastatic brain and spinal tumors with about 700 procedures each year. Treatment protocols include combinations of surgery, radiosurgery, traditional brain irradiation, adjunctive interventional neuroradiology, and systemic chemotherapy. Motor mapping under general anesthesia is routinely used for tumors in eloquent locations. In October 2012, the Clinic for Neurosurgery added a new instrument in managing skull base pathology by performing >50 transnasaltranssphenoidal endoscopic operations, thanks to the experience acquired in Naples, Italy, by one of the younger specialists at the Neurosurgical Clinic. This new technique is an additional way to manage skull base pathologies besides the already excellent microsurgical transsphenoidal and transcranial approach. The Cerebrovascular Surgery Service plays an important role within the Neurosurgical Clinic, specializing in complex cerebral aneurysms, arteriovenous malformations and carotid artery surgery with >350 cases per year. The Functional Neurosurgery Program focuses on epilepsy surgery, treatment of pain and spasticity and peripheral nerve surgery. In 2012, >50 epilepsy surgeries were performed. Since March 2012, 10 operations of vagus nerve stimulation for the treatment for epilepsy have also been performed. Pediatric neurosurgical diseases are an important segment of the Clinic's activities. They are handled by a special Service of Pediatric Neurosurgery with 16 beds where pediatric patients are cared for by a team of neurosurgeons and pediatric nurses, with the additional presence of a full-time pediatrician for routine consultation. The program specializes in epilepsy surgery and the treatment of brain and spinal tumors, craniofacial anomalies, spinal dysraphism and hydrocephalus. The Spinal Disorders Program specializes in the treatment of degenerative and traumatic spinal disorders involving a multidisciplinary approach to treating patients with spinal diseases. The Department of Neurosurgery has a Level I Trauma Center, which receives >15 000 visits per year.

There are 6 professors, 3 associate professors and 4 assistant professors from the School of Medicine of the University of Belgrade permanently employed at the Clinic. They actively take part in the practical and theoretical realization of the educational program of the School of Medicine and Clinic for Neurosurgery. Besides university lecturers, all other neurosurgeons also take part in teaching postgraduates and residents in neurosurgery.

Clinic for Neurosurgery is particularly active in postgraduate education of health care workers. Residents in neurosurgery come from all parts of the country and abroad. The Clinic maintains a permanent professional collaboration with many international neurosurgical centers where our doctors occasionally go for additional training. Always keeping in mind the importance of personal communications among the neurosurgeons, the Clinic for Neurosurgery has a tradition of inviting the best known world neurosurgeons to be the guests of the Clinic in Belgrade and exchange their experience.

The Serbian Neurosurgical Society (SNS) was established in 2006 in Belgrade after Montenegro independence. After Novi Sad and Niš it is permanently situated in Belgrade, Clinic for neurosurgery, Clinical Centre of Serbia. It is a member of EANS and WFNS. Currently there are 72 active members - neurosurgeons of this Society, and 28 residents and clinical doctors within the Serbian Neurosurgical Society.

On October 31st, 2013 there was a celebration of 90th Anniversary of Neurosurgery in Serbia and 75th Anniversary of Clinic for Neurosurgery in Belgrade. On that occasion Republic of Serbia and Serbian Neurosurgical Society was host of the The First Congress of Southeast European Neurosurgical Society, which was inaugurated as regional neurosurgical society. The Congress was held on October 31st-November 2nd 2013, in Belgrade, where 31 scientific sessions in which 257 presentations (127 presentations delivered by 113 of 117 invited faculty speakers from 32 countries, 62 oral presentation papers and 68 e-posters) have been held. Additionally, with the number of Congress attendees 317, accompanying persons, and exhibitors both medical 30 and nonmedical 70, total number of the Belgrade 1st SEENS Congress participants was finally 540, which made us proud and honored (29-39).

## 15. Neuroscience and Neurosurgery in Turkey

Modern surgery in Turkey started at military hospitals at the end of the 19th century in the Ottoman Empire; only limited procedures in neurosurgery were performed by general surgeons at the time. Cemil Topuzlu had an important role in establishing modern surgery in the Ottoman Empire. Topuzlu presented the neurosurgical drainage of a brain abscess at the French Surgery Society meeting in 1894 and subsequently published this report in a French surgical journal.

After formation of the new Turkish Republic in 1923, the first neurosurgical clinic was established by Abdulkadir Cahit Tuner. Tuner was originally a neuropsychiatrist, but he was trained in neurosurgery by Förster in Breslau, Germany, and on returning to Istanbul he performed the first laminectomy for a spinal tumor in Turkey and craniotomies for brain tumors and neurosurgical treatment for trigeminal neuralgia.

The first Turkish surgeon to train in neurosurgery was Hami Dilek. Dilek trained in France under Clovis Vincent, Thierry de Martel, and Guillaume. Dilek played an important role in establishing modern neurosurgery in Turkey. The first training program started in 1940, and Cemil Serif Baydur wrote the first neurosurgical textbook in Turkey. With the influence of Hami Dilek, the bylaws for specialty training in medicine were accepted in 1947, and neurosurgery became an official discipline. The first neurosurgical journal was published by Cafer Tayyar Kankat.

Mustafa Sakarya trained with Walter Dandy. Feyyaz Berkay was trained in the United States and became the first board-certified Turkish neurosurgeon; on returning

to his home country, he established an independent neurosurgery clinic at Istanbul University.

In the early 1950s, the first neurosurgery clinics were located in Istanbul. After the establishment of neurosurgery clinics in Istanbul, modern neurosurgery programs were started in Ankara by Nurhan Avman and Aykut Erbengi. These two neurosurgeons were trained in Boston under Poppen. In Turkey, Nurhan Avman established the neurosurgery department at Ankara University, and Aykut Erbengi established the neurosurgery department at Hacettepe University. During the establishment of the neurosurgery department at Hacettepe University, Pool, Sachs, and Wilson served in Ankara and contributed to the growth of the department. In 1967, Erdem Tunçbay established the neurosurgery department at Ege University in Izmir. In the late 1960s, these three departments brought renewed energy to Turkish neurosurgery.

After the 1980s, international ties and collaborations increased significantly. Increased numbers of neurosurgeons visited and were trained at international centers, and many world-renowned neurosurgeons came to Turkey to share their experience. Scientific research also increased rapidly, and Turkish neurosurgeons had significant roles in the international collaboration for the advancement of neurosurgery. At the present time, all modern neurosurgical procedures are performed in Turkey at 53 university hospitals, 67 governmental teaching hospitals, 202 governmental general hospitals, and private institutions.

There are two neurosurgical societies in Turkey. The Turkish Neurosurgical Society was founded in 1985; it has 961 members and is based in Ankara. It organizes annual scientific meetings and publishes and distributes the Turkish Neurosurgical Journal in Turkish and in English. The Turkish Neurosurgical Society has 24 regulatory committees and 8 teaching groups (pediatric neurosurgery, spinal and peripheral nerve surgery, neuro-oncology, stereotactic and functional neurosurgery, neurovascular surgery, neurotrauma and neurologic intensive care, surgical neuroanatomy, and education of trainers).

The Nervous System Surgery Society was founded in 2005 in Istanbul with an aim to increase the quality of neurosurgery. The Nervous System Surgery Society has 109 members, organizes annual scientific meetings, and publishes and distributes the Journal of Nervous System Surgery in Turkish and in English.

Neurosurgery is a well-established medical specialty in Turkey that closely follows as well as leads technical and scientific advances of global neurosurgery. The main aim in Turkey is to increase quality and ensure standardization of patient care and residency training (40).

## 16. Founding of South East European Neurosurgical Society (SeENS) and International Neuroscience Journal (INJ)

As with all initiatives, the South East European Neuro-

surgical Society (SeENS) began as an Idea - an idea thoroughly engulfed in the pillars of knowledge, sharing, support and advancement through borderless collaboration. It is based in the basic human thirst for knowledge and betterment of oneself, as well as his/hers surroundings. In short, SeENS is all about the people it brings together.

Having all this in mind, and given the fact that we come from the Balkans (a rather turbulent area to live and work in, even in the best of times) we rather soon realized the importance of teamwork, support and sharing. For without any one of these three, chances are you won't make it in this place - and this is no understatement.

With all the ingredients needed for the Idea's growth and development, such as clear guidelines, common goals and good professional climate, the SeENS slowly but surely started to surface in the real world. The South East European Neurosurgical Society began taking shape, and as it did so, so was our mission clearer to all participating parties...and there is a number of them, as will be outlined in more detail soon.

The South East European Neurosurgical Society became a professional society, a sort of guild, dedicated to the betterment of all things related to Neurosurgery as a whole. The region of its influence, as the name clearly states, is that of South East Europe. The Society has to provide support to all neurosurgeons and help them advance in their craft. By doing so, it does not only influence their individual lives, but the region as well - with more educated, trained and adapted neurosurgeons, faster and more reliable operations, better recovery rates, more success stories are more realistic in obtaining...the possibilities are endless!

Southeast Europe Neurosurgical Society (SeENS) is currently in the process of registration as an affiliated regional society member of the World Federation of Neurosurgical Societies (WFNS) with the official continental recommendation of European Association of Neurological Societies (EANS) like an officially affiliated regional society member of EANS.

European Association of Neurosurgical Society (EANS)

## 17. Southeast Europe Neurosurgical Society (SeENS) - Driving Principles Behind the Idea

After SeENS has been founded and legally accepted into the neurosurgical society worldwide, it is important as ever to promote, endorse and fulfill the founding principles on top which the society was built - sharing knowledge, organizing workshops and master classes, building professional networks and training centers are just some of the cornerstones that constitute the building blocks of SeENS.

Through this realization, the SeENS came to be - its main objective is to create a place of learning, support and advancement for all our colleagues on the region of South-East Europe. We feel that in these turbulent times it is our

responsibility and duty to stand together and provide a sanctum of knowledge for all those that seek it.

Being part of SeENS is all about responsibility – no longer does one represent his personal beliefs but also those of his peers, his friends, his colleagues; personal integrity – one must take a stance and be prepared to stand behind his/hers words; teamwork – we do work for all neurosurgeons that have given us their trust.

And it is with this mission and vision that we continue to improve SeENS every day. For with an open mind (coming from a neurosurgeon, this expensive can speak volumes) and heart it is that we put our labors and efforts into SeENS, all towards creating a better environment for neurosurgery as an art and craft, not only in South East part of Europe but the world as a whole.

Putting our strengths and weaknesses together, we are able to achieve unity as it was never before imagined. The times we live in are challenging and turbulent so it is our duty, and our privilege, to create a better perspective for neurosurgery and the many patients that are in need of us.

The first SeENS Congress was held on October 31st-November 2nd 2013, in Belgrade, where 31 scientific sessions in which 257 presentations (127 presentations delivered by 113 of 117 invited faculty speakers from 32 countries, 62 oral presentation papers and 68 e-posters) have been held. Additionally, with the number of Congress attendees 317, accompanying persons, and exhibitors both medical 30 and nonmedical 70, total number of the Belgrade 1st SEENS Congress participants was finally 540, which made us proud and honored.

The second SeENS Congress is to be held on October 22nd-25th 2015 in Sarajevo, Bosnia and Herzegovina.

Southeast Europe Neurosurgical Society (SeENS) appeared almost simultaneously with the idea of the International Neuroscience Journal (INJ) (39). Among all other regions, this coincidence to have regional section in such distinguished international, i.e., global scientific journal is of outmost importance for Southeast Europe neuroscience and neurosurgery. This fact will strongly contribute to interactive strengthening between basic neurosciences and neurosurgery in Southeast Europe with mutual major goal to improve quality of lives of all people, especially patients.

## 18. Final Remarks

Since the beginning of my career, I had the luck and privilege to meet many like-minded people that soon became my teachers and, as the years passed us by, have grown into people I fondly call friends. Our mutual friendship is one based on professional interest, similar goals and hunger for knowledge – and, as a team, we slowly but steadily managed to gather all of these. Of course, as the saying goes, the more we've been learning the clearer the lacks and gaps in our knowledge...but it was much easier to point them out to each other and even easier to patch

them with the techniques and experience we were missing. And this goes on until this day.

In my opinion The International Neuroscience Journal is unique and outstanding opportunity which will integrate together all renowned people worldwide who devoted their lives to take care about the progress expanding their knowledge in neurosciences and neurosurgery to make a lasting impression to the world of tomorrow... today. My congratulations, honor and respect to Professor Madjid Samii, whose energy is spiritus movens for constant activities and efforts which are leading to better tomorrow. I am more than convinced that The International Neuroscience Journal will be a state of the art in neuroscience and neurosurgery scientific sky giving possibility to all, especially young neuroscientists for their future development and achievements considering scientific, educational, professional, academic and social networking, highlighted by multicultural identity, focus, and culture of all. All above mentioned is of outmost importance, particularly for Southeast Europe.

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