



History and development of teaching Anatomy in University of Zagreb



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**University of Zagreb School of Medicine
Department of Anatomy and Clinical Anatomy
Institute of Anatomy "Drago Perović"**

HISTORY AND DEVELOPMENT

Date of Establishment and List of Heads of the Institute of Anatomy and Chairs of the Department of Anatomy

On January 12, 1918, the first lecture at the School of Medicine in Zagreb was delivered under the title *"Guidelines for Teaching and Research in Anatomy."* The lecture was presented by Dr. Drago Perović, who served as the first chair of the Department of Anatomy and head of the Institute of Anatomy. He held these positions until his retirement in 1961, at which point Professor Jelena Krmpotić-Nemanić assumed the role of head of the Institute, remaining in the position until 1982.

From 1982 to 1986, Professor Vidko Rudež served as head of the Institute, later resuming this role from 1991 to 1995. Between these terms, from 1986 to 1991, Professor Slobodan Vukičević held the position, followed by Professor Vasilije Nikolić from 1995 to 1997. Throughout this period, heads of the Institute generally also held the role of chair of the Department of Anatomy, with two exceptions: during 1986–1988, when Professor Zlatko Kelović was chair, and from 1992 to 1994, when the chair was Professor Ana Jo Osvatić.

In 1994, Professor Ivan Vinter was appointed chair of the Department, and in 1997, he also became head of the Institute. He served in these dual capacities until 2012. During the 2012/2013 academic year, Professor Fran Borovečki served as head of the Institute and chair of Department, after which, from 2013 to 2018, Professor Lovorka Grgurević was head while Professor Zdravko Petanjek served as chair of the Department. Since 2018, Professor Zdravko Petanjek has held both positions.

The History of Teaching at the Department of Anatomy and the Origins of the Institute of Anatomy

The history of the Institute of Anatomy is intrinsically tied to the establishment of the School of Medicine in Zagreb. The founders of the School recognized the necessity of creating an anatomical institute as both a symbol and foundation for the institution. This institute was to attract the first generation of medical students, instilling in them a passion for the challenging yet noble field of medicine – a mission that has persisted to this day. Teaching anatomy remains a privilege, as it is a subject that students anticipate with great enthusiasm, find challenging, and study with unmatched passion.

Identifying the right individual to serve as the first professor of anatomy was of paramount importance. The role was entrusted to Dr. Drago Perović, a young assistant from Vienna, who served as the head of the Institute of Anatomy from its founding until his retirement in 1961. Even after his retirement, Academician Perović remained professionally active until his death in 1968, mentoring numerous young physicians during his tenure. His mentees included Professor Duvančić, the founder of the Institute of Histology, and Professor Križan, who became the first anatomy professor at medical schools in Sarajevo, Skopje, and Rijeka.

The work and legacy of Academician Perović defined the first 50 years of the Institute of Anatomy. During this time, he developed an institution that stood alongside the world's leading anatomical

centres in terms of organization and quality. At that time, anatomy was at the forefront of biomedical sciences. Although subsequent scientific advancements shifted anatomy into a more supportive role, the discipline has remained a critical foundation for educating top-tier professionals. It is notable that nearly all leading physicians in Croatian clinical medicine began their careers as assistants or demonstrators at the Department of Anatomy. Many of these individuals later became internationally recognized scientists in their respective fields.

Despite the economic and political challenges during Academician Perović's tenure, which limited the capacity of the Institute to retain a larger team of collaborators, he established the foundation for his successor, Academician Jelena Krmpotić-Nemanić. When she assumed the role of head of the Institute in 1961, favorable circumstances allowed her to significantly expand the teaching and research capacities of the Department, transforming it into an established institute. Academician Krmpotić-Nemanić is credited with maintaining the high standards set by her predecessor. She effectively utilized a period of relative prosperity to expand the Department's team and align anatomy teaching and research more closely with clinical applications. Her scholarly work in anatomy earned her considerable international acclaim. Additionally, her leadership style attracted outstanding collaborators, two of whom – Academicians Ivica Kostović and Slobodan Vukičević – went on to establish centres of excellence within the School of Medicine and are highly esteemed researchers in their fields.

The Early Years of the Department of Anatomy: The Expertise and Personality of Academician Perović as the Cornerstone of Excellence

The election of Academician Drago Perović was one of the most advantageous decisions in the history of the School of Medicine. It is essential to acknowledge the numerous qualities that distinguish this exceptional person. Dr. Perović was a student and assistant to Professor Ferdinand Hochstetter, the most influential anatomist of his era. Hochstetter, together with Carl Toldt, authored the first modern anatomical atlas for medical students, which remained the most widely used anatomical atlas for much of the 20th century. Alongside Gray's Anatomy, this atlas remains one of the most renowned anatomical references in history.

Interestingly, Dr. Perović began his career at the Vienna Institute of Anatomy alongside Eduard Pernkopf, the author of the first anatomical atlas with watercolor images. Many of the illustrations from this atlas continue to be reproduced in contemporary works by other authors.

During this period, anatomy was the cornerstone of medical education. Being selected as a demonstrator or assistant to such a prominent anatomist as Hochstetter signified exceptional professional, personal, and moral qualities. Additionally, this role offered unparalleled opportunities for professional growth. Not only that, Dr. Drago Perović was conferred his promotion *sub auspiciis Imperatoris* in 1913 in Vienna, which is special form of doctoral graduation and the highest possible distinction for academic achievements for a doctoral degree in Austria. This distinction was accompanied by the presentation of an imperial ring, which was ceremoniously awarded in the presence of the emperor. The ring, crafted from platinum, was worn over white gloves. At the centre of the ring, set in lapis lazuli, is the coat of arms and crown of Emperor Franz Joseph, meticulously rendered in fine diamonds. Surrounding the central motif are twelve additional diamonds. Although the ring is now housed in a museum in Trebinje, where Dr. Perović was born, only six of the original

diamonds remain. During wartime, Dr. Perović used some of the diamonds to support his family and to contribute to repairs at the Institute.

It is worth noting that such an honor was exceptionally rare for a non-native of the Austro-Hungarian Empire, especially considering the political climate of the time. This recognition reflects the immense respect Dr. Perović commanded through his work and abilities, even as an assistant.

Upon his arrival in Zagreb, Dr. Perović brought with him the tradition and methodologies of the Austro-Hungarian and German anatomical schools. As a result, from its inception, anatomy instruction at the School of Medicine in Zagreb matched the quality of leading European institutions. Furthermore, Dr. Perović's vision laid the groundwork for anatomy education in Zagreb to remain on par with the world's best throughout the 20th century.

Dr. Perović's visionary approach was evident as early as 1914, when he was invited to Belgrade to develop plans for an anatomical institute in anticipation of the establishment of a medical school there. Although the plan was halted by the outbreak of World War I, this experience influenced his work in Zagreb. Upon his arrival, he rejected proposals to design an institute for 25 students, instead advocating for facilities to accommodate 200 students per year, with the possibility to increase this number through organizing course curriculum consecutively for groups of students. Thanks to this foresight, the Institute of Anatomy in Zagreb continues to meet the demands of modern enrollment, which includes nearly 400 medical students annually, as well as approximately 100 dental medicine students.

Despite these logistical achievements, it was Dr. Perović's character that most significantly contributed to his lasting reputation and authority. Although he came from a remote part of the Austro-Hungarian Empire, his early education was of the highest quality. He completed secondary school in Mostar with distinction, where his teacher was the celebrated poet Jovan Dučić. Dr. Perović was erudite, with Homer's *Odyssey* being a favorite literary work that he studied in both original and translated forms. He admired poetry and literature, reading works by Dučić, Rakić, Cesarić, Verlaine, and Heine, among others. He had wide-ranging knowledge, including history, geography, technology, and arts, and was well-informed of global developments through journals like *Umschau*.

Dr. Perović was an ascetic and erudite individual, known for his strict discipline, which he applied both to himself and his surroundings. While studying in Vienna, he practiced fencing and served as a trainer for duelists, aiming to mediate conflicts through this role. His sense of justice earned him the admiration of students, despite his reputation for strictness.

Furthermore, one of the decisive reasons for Dr. Drago Perović's appointment as professor of anatomy was his use of the beautiful Herzegovinian dialect (Serbo-Croatian language), which assured his commitment to introducing Croatian terms into anatomy and medicine, while ensuring that no unnecessary neologisms would be created.

Dr. Perović dedicated his efforts to teaching future physicians, elevating anatomical education to a remarkably high standard. His lectures were theatrical events, delivered with precision and flair. Dressed in a specially tailored black cloak, striped trousers, and a red tie, he began each class punctually to the minute. His engaging oratory skills and talent for illustration attracted large audiences, with students arriving hours early to secure seats close to the front. Practical sessions often extended late into the evening, followed by rigorous oral examinations. His assistants rarely dared to leave the Institute early.

Development of the Anatomical Institute

When the School of Medicine was established, only two buildings existed on Šalata: the building that now houses the Institute of Anatomy and the present building of the School of Medicine that includes Dean's Office. Dr. Perović proposed using the right half of the current building for the Anatomical Institute, and work on its adaptation began immediately under the supervision of engineer N. Fischer. During the first semester, anatomy lectures were held in the old University building on Theatre Square. For the anatomy courses, two rooms in the Comparative Anatomy Institute, headed by Professor Lazar Car, were allocated in the basement to the left of the entrance stairs. These rooms included a small lecture hall and a laboratory. Dr. Perović spent each night preparing specimens for his first 63 students. He worked alone, with no one to assist him, and this continued for several years.

Following the example of leading European medical schools, Academician Perović invested considerable effort into creating anatomical specimens and organizing the Anatomical Institute. Aside from his organizational work, it is important to highlight Dr. Perović's contributions to the creation of the museum and the osteological collection of disarticulated skulls, as well as his efforts in mentoring staff and conducting scientific research. During Academician Perović's time, there were no computers or internet, and access to printed books was limited. Therefore, the variety of specimens was key to learning and review, and thanks to Academician Perović, the Anatomical Museum in Zagreb became – and remains – one of the best-equipped anatomical museums in the world. A unique feature of this museum is that it is located within the classroom, making it accessible to students and helping them master the subject matter of anatomy.

In the beginning, Professor Perović prepared many of the specimens himself until he received help from colleagues, including Dr. Kiljman and, for the first time, an assistant, Dr. Voneš. Later, he was joined by preparator Ivan Allinger. Among the most valuable specimens are the injection preparations, which require skill and patience.

Throughout his work, Academician Perović collected most of the specimens for the human skeletal collection, which includes fetuses from the earliest stages as well as all postnatal age groups. Of particular significance is the collection of 1,316 skulls – the largest skull collection in the world – which has served as the basis for numerous doctoral theses and scientific publications.

After 50 years of development, the Institute had become a large and well-established institution. It was structured into three departments:

1. The Department for Administration and Scientific Documentation, which included the office and secretarial services of the head of the Institute, the Economic Office, the Library, and the Office for Scientific Documentation. This department housed a library with about 3,300 books, 1,400 volumes of over 30 different journals, as well as a film and photo archive and an anatomical bibliography card file, which contained not only books owned by the Institute but also many works related to anatomy and related fields.
2. The Department for Teaching was considered the most important department in the Institute. It had three committees and one working group. The Committee for Second-Level Education planned anatomy courses for the first- and second-year students at the School of Medicine. This committee was responsible for modernizing and improving teaching, addressing all organizational matters, and producing textbooks. The second committee was responsible for postgraduate education and anatomy workshops. Interestingly, postgraduate teaching was held at the Faculty of Science and the Faculty of Humanities and Social Sciences, but not at the School of Medicine. A

special working group was responsible for teaching at other faculties and higher education institutions, such as the School of Dental Medicine, the Faculty of Science, the Faculty of Physical Education (today's Faculty of Kinesiology), the Higher School for Nurses and Health Technicians, and the Higher Dental Schools in Osijek and Split. This working group was established at the initiative of Institute staff to coordinate teaching across various faculties and high schools. Younger staff members from the Institute also taught at medical higher schools. Interestingly, within this Department, there was also a Committee for Introducing Students to Scientific Work, which aimed to guide students in the fundamental methodology of scientific research in the field of morphological studies. Within this committee, there was also a Demonstrators' Section, which was responsible for their professional development.

3. The Department for Scientific Research had several sections: the Section for the Anatomy of the Locomotor System and Biomechanics, the Section for Anthropology, the Section for Experimental Morphology, the Section for Neuroanatomy and the Anatomy of Sensory Organs, the Section for Radiological Anatomy, which had two X-ray machines, an X-ray room, a film archive, and a training hall for radiological anatomy. The Section for Topographical and Surgical Anatomy had an operating theater for experiments on larger animals.

In addition to these three departments, the Institute also had a Laboratory for the Preparation and Preservation of Corpses and Specimens, an Osteological Collection, a Museum-Classroom for students, a Laboratory for the preparing injection, corrosive, and special preparations, and a Dissection Hall.

At that time, the Institute of Anatomy was led by Academician Jelena Krmpotić-Nemanić, who, after Academician Perović's retirement, contributed significantly to transforming the Institute into a well-organized anatomical institute of international standing. Professor Krmpotić-Nemanić, continuing the work of her teacher, Academician Dr. Perović, developed his school, particularly in the areas of clinical and functional anatomy. Under her leadership, many teachers and researchers were trained. While maintaining a traditional approach to anatomy, she encouraged a more clinically oriented education for her staff. As a result, many of the teachers who continued their careers in anatomy spent the rest of their professional lives in the field, including Academician Krmpotić-Nemanić herself, who was an otorhinolaryngologist, specialized in clinical areas.

Although the Institute of Anatomy in the 1970s had all the organizational and professional capacities to coordinate teaching, scientific, and professional activities in the field of anatomy at the University of Zagreb, it experienced a degree of fragmentation due to objective circumstances and changes in the organization of the University and its teaching activities. With the independence of other faculties within the University, the separation of the Higher school for health studies, and the independence of other medical schools in Croatia, the organization of teaching was no longer under the authority of the Institute of Anatomy. Today, the Department of Anatomy is responsible for teaching in the undergraduate program of the School of Medicine, with a formal agreement in place for teaching with the School of Dental Medicine. Although the teachers from the Department also participate in teaching anatomy at other higher education institutions, there is no formal cooperation with many faculties where human anatomy courses are taught, such as the Faculty of Kinesiology or the Faculty of Pharmacy and Biochemistry.

In scientific terms, there has also been a reduction in morphological research. This is largely due to the development of other scientific fields, primarily molecular biology and genetics, as well as the

departure of former staff to other institutions. With the departure of Academician Pavao Rudan, the Section for Anthropology was discontinued, and due to shifts toward other scientific disciplines, both the Section for Experimental Morphology and the Section for Topographical and Surgical Anatomy were phased out. As no new equipment was acquired, the Section for Radiological Anatomy was also closed. In the 1990s, significant scientific activity continued in the Laboratory for the Anatomy of the Locomotor System and Biomechanics, while the Neuroanatomy Laboratory continued to grow and became the core of the future Croatian Institute for Brain Research, organizational unit of University of Zagreb School of Medicine. In 1987, the Laboratory for Mineralized Tissues was established, and under the leadership of Academician Slobodan Vukičević, it has remained one of the most productive and internationally recognized laboratories at the University of Zagreb School of Medicine to this day.

The Institute of Anatomy as a Centre for Leading Croatian Physicians and Distinguished Scientists Abroad

The Institute of Anatomy has always been, and continues to be, a nurturing ground for physicians who will play leading roles in Croatian medicine and its medical institutions. Many assistants and teachers from the Institute have achieved significant, internationally recognized scientific careers in leading institutions worldwide.

Academician Jelena Krmpotić-Nemanić possessed several key characteristics that contributed to her success and her outstanding contributions to the development of science in Croatia through her entire scientific career. She had an excellent classical education, was fluent in several languages, possessed sharp judgment, and had a creative approach with numerous ideas. She understood the importance of international recognition and had a remarkable ability to select collaborators. She always chose the best individuals and guided them in fields where they achieved outstanding results.

As a special recognition for her contributions to anatomy, Academician Krmpotić-Nemanić was entrusted with the editorial work for the 26th and 27th international editions of the Told-Hochstetter anatomical atlas, then the most esteemed anatomical atlas, which she and her colleagues also translated into Croatian. As a clinician specializing in otorhinolaryngology, she published the *Surgical Anatomy of the Head and Neck* atlas in German, English, and Italian (*Springer-Verlag*, Berlin – Heidelberg – New York, 1988). Within the realm of clinical anatomy, it is also essential to mention her three editions of the globally recognized and widely cited book on peripheral nerve compression syndromes (*Pećina M, Krmpotić-Nemanić J, Markiewitz AD. Tunnel Syndromes. Peripheral Nerve Compression Syndromes. Third Edition. CRC Press LLC, Boca Raton–London–New York–Washington DC., 2001*).

Four of today's regular members of the Croatian Academy of Sciences and Arts (CASA) – Academicians Marko Pećina, Pavao Rudan, Ivica Kostović, and Slobodan Vukičević – are former students of Jelena Krmpotić-Nemanić. It is also important to highlight Davor Solter, the director of the Max-Planck Institute of Immunobiology and Epigenetics in Freiburg.

Without the support of Academician Krmpotić-Nemanić, Dr. Davor Solter, one of the most renowned developmental biologists in the world, would not have developed the histochemistry laboratory, later joined by Vladimir Rukavina and Ivica Kostović. For Ivica Kostović, starting research in the histochemistry laboratory was a solid foundation for his doctoral dissertation at the Ruđer Bošković Institute and the development of experimental neuroanatomy, which at the time was considered "unusual" for anatomists. In the histochemistry laboratory, renowned gynecologist Velimir Šimunić

started his first steps in scientific research, as did many other distinguished Croatian physicians, including Pavle Miklič, Augustin Mijić, Darko Chudy, and others who are now recognized scientists and doctors working abroad, such as Ladislav Mrzljak, Nenad Bogdanović, Ivana Dellale, Mladen Roko Rašin, and Nenad Šestan.

Pavao Rudan continued to develop the field of anthropology at the Faculty of Science at the University of Zagreb and later, within the Laboratory for Epidemiology of Chronic Diseases and Anthropology at the Institute for Medical Research and Occupational Health at the University of Zagreb. He later founded and became the first long-serving director of the Institute for Anthropological Research.

In addition to these prominent physicians and scientists, it is worth mentioning other long-serving teachers who worked for many years as assistants, assistant professors, and professors at the Department of Anatomy. These include Vidko Rudež, a radiology specialist; Predrag Keros, a neurosurgeon, surgeon, and orthopedist; Professor Emeritus of the School of Medicine in Zagreb Vasilije Nikolić, a surgical specialist; Ana Jo Osvatić, an ophthalmologist; Ilija Petrušić, a neurosurgeon, all of whom retired from these positions. Additional assistant professors and professors at the Department of Anatomy included Čedomil Bagi, Ladislav Mrzljak, Mirjana Ivančić Košuta, and as assistants at the Department of Anatomy, Mladen Stojanović, Izidor Papo, Pavle Sokolić, Mladen Stulhofer, Feđa Raić, Radovan Medved, Vladimir Hudolin, Željko Lulić, Branko Budisavljević, Radovan Budisavljević, Dubravka Gomerčić, Ljiljana Audy, Vladimir Rukavina, Boris Pegan, Damir Buković, Vlado Deponte, Tomislav Mihaljević, Velimir Šimunić, Miljenko Solter, Josip Paladino, Ranka Štern Padovan, Josip Pasini, Veljko Grljušić, Nina Canki Klein, and Miljenko Brnobić.

Teaching Activities

Teaching has always been the fundamental task of the Institute of Anatomy. Upon arriving in Zagreb, Professor Perović did not want any experimentation with the curriculum and organized the teaching according to the program of the medical school in Vienna. He utilized the most modern teaching aids available at the time, such as the epidiascope and film projector, and had a large collection of diapositives that he used in his lectures. Drawing was the foundation of his lectures, and over time, many wall charts were created. Based on the lectures held by Academician Perović, demonstrators and assistants prepared teaching materials, which were then converted into printed form and quickly became the official textbook. It is worth noting that the textbook was officially published by the Medicinska knjiga in two parts, with the final edition published in 1964 after Academician Perović's retirement. Interestingly, the book was titled "*Perovićeva anatomija čovjeka*" (Perović's Anatomy), but Academician Perović never signed this book, nor were the authors listed. Regardless, the book was well organized didactically and is still used today, even in its original form. Most of the chapters were later revised by the teachers of the Department of Anatomy and published in a few issues. Based on the structure of this book, the first complete textbook was written under the main editorship of Academician Jelena Krmpotić-Nemanić. In addition to these textbooks, the teachers of the Department of Anatomy and Clinical Anatomy are authors and co-authors of numerous textbooks and books covering topics in anatomy and clinical anatomy of specific body parts. Notably, Professor Predrag Keros and Academician Marko Pećina have made significant contributions in this field.

It is also important to mention that the first anatomical textbook in Croatian was written in the 19th century by Dr. Ante Schwarz under the title "*Opisna anatomija ili razudbarstvo čovječjeg tijela*" (Descriptive Anatomy or Dissection of the Human Body), which consists of two volumes—

Volume I: Description of the Skeleton, Muscles, and Senses; Volume II: Description of the Internal Organs, Nerves, and Vessels, and Terminological Explanations (Zagreb, 1873–1874).

The curriculum of the anatomy course did not change significantly in terms of its main structure until the 1980s. Anatomy teaching took place over the first three semesters, where the first semester covered the locomotor system, with a detailed focus on bones and joints. In the second semester, cadaveric dissection was carried out, with the teaching adapted to topographical anatomy. The third semester covered the anatomy of the central nervous system and the functional anatomy of sensory and motor systems, with a focus on the functional organization of the brain. There were occasional deviations from this structure, but the course generally followed this organizational structure. Since the mid-20th century, the rapid development of molecular biology has had a profound influence on advancements in neuroscience. New discoveries in the physiology of the central nervous system influenced the organization of teaching in the Physiology course at the School of Medicine. Recognizing the importance of these changes, Academician Kostović encouraged the development of a new course that would integrate anatomy and physiology of the central nervous system. Despite strong resistance that persisted for decades after the introduction of the course, with the support of physiologist, Professor Nikša Pokrajac, the first interdepartmental course, *Organization and Function of the Central Nervous System*, was launched in 1984. The School of Medicine in Zagreb was among the first in the world to recognize the importance of integrated teaching of anatomy and physiology of the central nervous system, establishing it as a separate course.

Although the course was conducted for 15 years as an integrated curriculum covering neuroanatomical and neurophysiological topics, full integration within the subjects themselves was not achieved. Academician Kostović (first and honorary director of Croatian Institute for Brain Research) and Professor Miloš Judaš (present director of Croatian Institute for Brain Research), together with collaborators, published the textbook *Organization of the Central Nervous System* and the practical *Atlas of Functional Neuroanatomy*, while the physiological topics were taught according to the then-current textbook of Medical Physiology (written by Arthur Guyton) supplemented with additional notes. The exam was organized as a joint examination by two examiners, one from the Department of Anatomy and Clinical Anatomy and the other from the Department of Physiology. This integrated form of teaching and knowledge assessment continued until 1998, when the subject *Fundamentals of Neuroscience* was formally established by a council comprising the teachers from both the Department of Anatomy and Clinical Anatomy and the Department of Physiology.

With the establishment of the new subject that integrated anatomy and functional anatomy of the central nervous system, anatomy became a two-semester subject in the first year, and this structure has remained the same to this day. Although there was a significant decrease in the number of cadavers in the 1980s, the dissection was still conducted in a demonstrative way, as the number of body donors did not allow for dissection of more than 2-3 cadavers per academic year. Additionally, during this time, major transformations took place in anatomy education at universities worldwide, with traditional anatomical teaching being entirely abandoned, even at some esteemed medical schools with a long history of teaching anatomy.

It is interesting to look back at the text written by Professor Žarko Dolinar in the leading anatomical journal of the time, *Acta Anatomica*, upon the death of Academician Perović. Professor Dolinar, a world and multiple-time national table tennis champion, as well as a Croatian scientist who had lived and worked in Basel, Switzerland, since 1963, where he habilitated at the medical faculty and taught

for over 25 years, had remained in contact with Professor Perović until his last days. Professor Dolinar mentioned Perović's concern that, with the desire to modernize the faculty and its teaching, fundamental disciplines might be reduced, and that this could lead to a decrease in standards and the quality of the study.

Therefore, it's worth noting that these trends are not new, although it is evident that anatomy education must evolve and align with the demands of the modern era. One thing, however, remains unchanged: every future student who wishes to be a good and successful doctor must have a thorough understanding of the human body. Also, regardless of new technologies and digitalization, no other method will allow for the same understanding of the human body and introduce students to the world of medicine as effectively as dissection will.

Academician Perović once said: "Only daily dissection, studying prepared specimens, and reading extensive literature allow for finding new paths and new applications of anatomy. Anatomy could only develop into a scientific discipline once human bodies were dissected. It gained its true meaning when it was applied to clinical practice, i.e., when anatomists and clinicians started complementing their experiences and research; when clinicians posed questions that anatomists could answer, or when anatomists alerted clinicians to clinically significant details."

In the last 20 years, the Department of Anatomy and Clinical Anatomy has made significant strides in preserving the traditional methods of detailed study of the human body and cadaver dissection, while simultaneously advancing in the teaching of anatomy as an applied anatomical science. At the initiative of Professor Ivan Vinter, then the Chair of the Department, in 2009, the textbook *Waldeyer's Anatomy of the Human Body*, one of the world's most renowned textbooks that retained the traditional approach to anatomy in the context of clinical application, was translated. Additionally, through greater public presentation and popularization of the Body Donation Program, led by Professor Lovorka Grgurević since 2013, there has been a substantial increase in the number of body donors, which has allowed dissection to be carried out in smaller groups of students, giving them the opportunity to independently dissect the body.

In 2019, a new textbook *Duale Reihe Anatomie* used at the medical school in Heidelberg was translated, regarded by students as the best and most illustrative anatomy textbook in Germany. It combines a classic approach with the modern application of anatomical knowledge. The collaboration with the medical school in Heidelberg is especially important as it exemplifies how a medical curriculum should incorporate fundamental medical disciplines, starting with an in-depth dissection of the human body in the first semester.

In the same year, the textbook *Anatomia humana*, authored by Professor Dubravko Jašovec, a teacher in the Department and thoracic surgeon, was published. This original work is presented in a special didactic format and covers all topics in classical human anatomy. This textbook is also the official textbook for the Anatomy course and is particularly suitable for learning anatomy during practical classes.

Perović-Krmpotić Foundation

Every year, hundreds of young medical graduates from the School of Medicine in Zagreb, enter the professional world as fully prepared physicians. All these young individuals drew their first insights of the medical profession at the Institute founded by Professor Perović. This was the reason why his students, friends, and admirers decided to establish the Drago Perović Foundation in 1968. The

establishment of the Foundation was motivated by Professor Drago Perović's extraordinary dedication to pedagogy, as he devoted his entire tireless work ethic primarily to medical students.

The purpose of the Foundation was: to award the best student at the School of Medicine in Zagreb each year, to award the best student thesis in the field of morphological sciences annually, and, depending on its capacity, to provide necessary financial support for students' research work. Today, the award is given to the best student of the generation, and through the initiative of Professor Ivan Vinter, the Foundation was renamed the Drago Perović and Jelena Krmpotić Foundation as academician Krmpotić bequeathed both financial support and a will for the Foundation, thus completing her contribution to anatomy in Croatia.

Artistic Work at the Institute of Anatomy

Teaching Through Drawing in the Education of Future Physicians

Upon arriving in Zagreb, Academician Perović did not wish to experiment with the curriculum and organized the teaching according to the program at the medical school in Vienna. He used the most modern teaching aids available at the time in his instruction. However, drawing was the foundation of his lectures, and over time, many wall charts were created.

In the past, teaching in the medical curriculum was generally unimaginable without the use of drawings to visually present anatomical structures. At the onset of lectures, there were no diapositives, films, or computers, so it was essential to show students the shapes, forms, and structures clearly. During this time, special spaces were constructed for the artists, including art studios. The School of Medicine in Zagreb, in terms of its equipment, educational approach, and awareness of the importance of visual perception in education, was on par with leading medical schools worldwide.

Since its founding in 1917, and for nearly a hundred years thereafter, visual and artistic communication in the educational process, student training, and the popularization of medicine more broadly, at the School of Medicine in Zagreb, involved 17 academic painters and 3 draftsmen. They made a significant contribution throughout their careers, providing key innovation in teaching, professional, and scientific work in the fundamental subjects of the medical curriculum and contributing to the success of the faculty's activities. It is worth noting that the School of Medicine was one of the few educational institutions that, due to the nature of its teaching, established permanent employment contracts with professionally trained artists – academic painters – who worked as art collaborators, illustrators, applying visual arts in medicine, anatomical drawing, and medical illustration. To this day, their contribution and the role they played in the educational process and student development have not been fully recognized, and the last reflection on the importance of drawing in education at the School of Medicine dates to 2007.

Academic Painters at the Institute of Anatomy

Drawings hold particular significance in the teaching of morphological subjects, where it is important to present as much of the structure as possible in a clear and simple way. Visual perception and visual memory are of utmost importance and, as a teaching method, they provide the best results in understanding anatomical structures. In the past, students were so captivated by the drawings that they started creating their own during lectures, frequently reproducing the wall charts that accompanied the lessons.

At the Institute of Anatomy, drawings ranging from A4 format to sizes larger than B0 are preserved. These are works by four academic painters who worked at the Institute from 1917 to 2001, creating anatomical drawings. Until the 2020 earthquake, some of these works of art adorned the walls of the Institute. The painters had their own studio at the Institute, where they also created valuable artworks in addition to anatomical drawings. Ivan Tabaković painted for the Institute until 1923, followed by Anka Krizmanić from 1931 to 1951, Štefanija Canki Pažić from 1946 to 1972, and finally, Edita Schubert from 1973 to 2001.

Ivan Tabaković was one of the co-founders of the *Zemlja* group, which was established in 1929 by renowned painters, architects, and sculptors (Antun Augustinčić, Vinko Grdan, Krsto Hegedušić, Drago Ibler, Leo Junek, Frano Kršinić, Omer Mujadžić, Oton Postružnik, and Kamilo Ružička), and he exhibited at their first exhibition in the Ulrich Salon in 1929. He received important recognitions, including the Grand Prix at the *Exposition Internationale des Arts et Techniques dans la Vie Moderne* in Paris in 1937, and a gold medal at the International Exhibition of Ceramics in Prague in 1962.

Anka Krizmanić was recognized as an artist at the European level and was one of the few Croatian artists noted in early historical-artistic surveys. However, it wasn't until a retrospective exhibition in 1986 at the Art Pavilion in Zagreb and the monograph by Ivanka Reberski (1993) that she was officially acknowledged as one of Croatia's most important artists. She studied at the Arts and Crafts School in Dresden, graduating in 1917, where she received a silver medal for her best work in graphic arts. As a French government scholarship holder, she stayed in Paris in 1929 and 1930. She created numerous works, beginning with pastel portraits in her youth. Her work evolved through Dresden's impressionist symbolism and expressionism, and she made an authentic contribution to the neorealism of the 1920s. Later, she established a subjective coloristic interpretation and poetics, completing a rich and thematically coherent body of work in portraits, landscapes, and dance and folklore motifs.

Edita Schubert is considered one of the leading Croatian artists of the 20th century and a key figure in the European avant-garde of the late 20th century. Initially, she painted hyperrealistically, then created magical installations using modest materials (leaves, fabric, sand), which she combined with painted surfaces (e.g., *Comet Tail*, 1981). In the late 1980s, she painted compositions with intense colors in the spirit of new geometry (*Untitled-Cathedral*, 1987), and later, in her attempt to place individual levels of reality into a broader context, she created environmental installations (*My Apartment*, 1999) and web art (*Walks*, 2001). Her works have been exhibited in the Museum of Contemporary Art and the Modern Gallery in Zagreb, and in 2015, a retrospective exhibition was held at Klovićevi Dvori to mark the 15th anniversary of her passing.

COURSES AT OTHER UNIVERSITY INSTITUTIONS IN ZAGREB

At the University of Zagreb, in both undergraduate and graduate programs, teachers from the Department of Anatomy and Clinical Anatomy fully teach the Anatomy course in the Integrated undergraduate and graduate university study of Dental Medicine, as well as the course *Selected Topics in Functional Human Anatomy* in the Nutrition Study Program at the Faculty of Food Technology and Biotechnology. They also contribute to the Anatomy course in the Rehabilitation and Speech and Language Pathology Study Programs at the Faculty of Education and Rehabilitation Sciences. Additionally, teachers from the Department of Anatomy contribute to the Anatomy course at the medical school in Mostar.

At the University of Zagreb, in both undergraduate and graduate programs, teachers from the Department of Anatomy and Clinical Anatomy are also heads of and fully teach mandatory and elective courses at the Faculty of Croatian Studies, the Faculty of Humanities and Social Sciences, and the Faculty of Education and Rehabilitation Sciences.

SCIENTIFIC ACTIVITIES

In the past 10 years, teachers from the Department of Anatomy and Clinical Anatomy have published more than 300 scientific papers and have been cited more than 6,000 times. The teachers and their collaborators are the leaders of numerous international and domestic projects, including projects HORIZON and FP7.

PROFESSIONAL ACTIVITIES

Teachers from the Department of Anatomy and Clinical Anatomy are members of various professional associations at the national and international levels, including the Croatian Society of Morphologists, the European Federation for Experimental Morphology, the Croatian Society for Neuroscience, the Federation of European Neuroscience Societies, among others. They are leaders of courses and contribute to postgraduate professional studies, as well as continuing education programs.

Additionally, they have founded several laboratories and significantly advanced the profession and science by introducing new research techniques. They serve as reviewers for national and international projects, as well as for leading global scientific journals. They have also been involved in organizing numerous congresses, symposia, courses, and summer schools.

Faculty members from the Department of Anatomy and Clinical Anatomy also engage in public outreach activities, including Open Days at the School of Medicine for high school students, the Croatian Science Festival, Brain Awareness Week, and other similar events.

The Body Donation Program, established by Professor Ivan Vinter, was modernized in 2014 under the leadership of Professor Lovorka Grgurević and has since become widely recognized, leading to an increase in the number of body donors.

EQUIPMENT AND WORKSPACES

The Institute of Anatomy "Drago Perović" consists of a lecture hall (an amphitheater for 200 students), 6 well-equipped seminar rooms (for 40 students), 2 large dissection rooms (with 18 dissection tables), and two smaller dissection rooms (with 2 dissection tables). The Institute also includes an anatomical museum (for 80 students), a memorial room with a unique developmental osteological skull collection, a large library, apartments, offices, and a morgue with the capacity to store 50 bodies at -20°C and 30 bodies preserved for anatomical dissection.

Also, the Institute contains several office spaces for staff and auxiliary rooms. The Institute also houses the Laboratory for Mineralized Tissues, led by Academician Slobodan Vukičević, which includes its own vivarium for small animals, as well as the Laboratory for Regenerative Neuroscience, led by Professor Srećko Gajović. The Institute also houses a Histomorphometry Cabinet of the Laboratory for Molecular Immunology led by Professors Nataša Kovačić and Vedran Katavić.

It is important to note that alongside the unique skull collection, the Institute has also developed a unique neuroembryological collection, which is now stored at the Croatian Institute for Brain Research.

The Zagreb Skull Collection is a unique identified collection of human skulls from fetuses to centenarians. It is comprising of more than 1100 skulls and skull bone sets from the early fetal period to centenarians. The Zagreb Skull Collection consists of two main parts: the unique Collection of Skull Bones containing 386 sets of separated skull bones from the early fetal period to adulthood and the Collection of Skulls containing 742 skulls (age range 4-101 years). The collection was the core source for numerous anatomical studies on the development, postnatal changes, and anatomical variations of the skull.

The Zagreb Collection of human brains was founded at the University of Zagreb School of Medicine in the early 1970s by Professor Ivica Kostović. Over the last 40 years, the Collection has been augmented with over 100 000 histological slides of brain tissue. The tissue samples were obtained from more than 1300 human brains in all stages of development, including fetal and early postnatal period, both from healthy individuals and individuals with developmental, psychiatric, and neurological conditions.

The Institute of Anatomy was severely damaged in the 2020 earthquakes and was evacuated in the summer of 2023 for a full renovation, which will include a structural renovation to increase the static safety of the building but also includes a full energy renovation and modernization. The return to Institute is scheduled to March 2025.

Suplement:

ZagrebHISTORY2overview.pdf – presentation of Institute

ZagrebHISTORY3skullColl.pdf – manuscript about Skull collection

ZagrebHISTORY4brainColl.pdf – manuscript about Zagreb neuroembryological collection

ZagrebHISTORY5artDraw.pdf – manuscript about artist working for Institute (Croatian)

ZagrebHISTORY6PerovicFirstLect.pdf – Drago Perović first lecture (Croatian)

ZagrebHISTORY7memoarAnatBegining.pdf – Milan Rojc memoir's (Croatian)