UNIVERSITY OF ZAGREB, SCHOOL OF MEDICINE

PROPOSAL OF THE DOCTORAL STUDY PROGRAMME

BIOMEDICINE AND HEALTH SCIENCES

Zagreb, 11 April 2019

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A. OVERVIEW OF THE STUDY PROGRAMME

A.1. GENERAL INFORMATION ON THE PROPOSED DOCTORAL STUDY

A.1.1. NAME OF THE PROPOSED DOCTORAL STUDY

University postgraduate doctoral program Biomedicine and Health Sciences

A.1.2. NAME OF THE PROVIDER OF THE STUDY PROGRAMME

University of Zagreb School of Medicine

THE COOPERATING INSTITUTION(S) PARTICIPATING IN THE STARTING AND IMPLEMENTATION OF THE DOCTORAL STUDY

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A.1.3. NAME OF THE IMPLEMENTER OF THE STUDY PROGRAMME

University of Zagreb School of Medicine

A.1.4. SCIENTIFIC OR ARTISTIC FIELD AND DISCIPLINE OF THE PROPOSED STUDY PROGRAMME

Area: biomedicine and health sciences

Field: basic medical sciences; clinical medicinal sciences, public health and health care

Branch (if the doctoral study is performed in a branch):

A.1.5. DURATION OF THE DOCTORAL STUDY IN ACCORDANCE WITH THE REGULATIONS (IN YEARS)

3

A.1.6. NUMBER OF REQUIRED COURSES/MODULES

8

A.1.7. NUMBER OF ELECTIVE COURSES/MODULES OFFERED WITHIN THE DOCTORAL STUDY

78

A.1.8. ACADEMIC TITLE EARNED UPON COMPLETION OF THE DOCTORAL STUDY

Doctor of Science - PhD

A.1.9. PROPOSED SMALLEST NUMBER OF DOCTORAL STUDENTS FOR ONE ACADEMIC YEAR

15

A.1.10 PROPOSED HIGHEST NUMBER OF DOCTORAL STUDENTS FOR ONE ACADEMIC YEAR

50

A.2. INTRODUCTION

A.2.1. REASONS FOR STARTING THE PROPOSED DOCTORAL STUDY

This proposal presents the Postgraduate University (PhD) Programme Biomedicine and Health Sciences at the University of Zagreb, School of Medicine in the process of re-assessment of the study programme after an international evaluation carried out in November 2016.

The reasons for establishing this PhD programme were based on the need to sustain and advance scientific work in the field of medicine and health care in the Republic of Croatia in order to improve and promote people's health through renewal of human resources, primarily in academic, scientific and leading professional institutions (university and clinical hospitals, healthcare institutions and institutes), state administration (ministries, republic and county bureaus, agencies), and in the business sector, which requires complex task solving and decision-making using scientific methodology (in the pharmaceutical industry, biotech companies, etc.).

The PhD programme Biomedicine and Health Sciences at the University of Zagreb, School of Medicine is the first PhD programme in the Republic of Croatia, which has, since its foundation, been continuously developed and improved in accordance with Croatian higher education strategies, mission and Science Strategy of the School of Medicine and European standards (http://www.orpheus-med.org /images/stories/ documents/ORPHEUS-AMSE-WFME-standards-for-PhD-education.pdf).

Historically, the first PhD thesis at the University of Zagreb, School of Medicine was defended in 1954. Thereafter, the number of PhD theses gradually increased, and in the mid-1970s the PhD thesis became a pre-requisite for scientific-teaching appointments. Only after the establishment of the PhD programme does the PhD thesis become the responsibility of not only mentors and PhD candidates but also universities. Since the mid-1990s, this idea has been gradually developed by the European University Association (EUA) and has become a public policy in 2003 when the Berlin Ministerial Communiqué consequently defined doctoral programmes as the third cycle of the Bologna process (http://www.ehea.info/cid100938/ministerial-conference-berlin-2003.html).

PhD programme Biomedicine and Health Sciences started initially as a master's degree program called “Biomedicine” in the academic year 1997/1998, due to legal framework. From the academic year 1999./2000. the study programme changed its aim and the name to "Medical Science", and started enrolling students with the explicit intention of continuing into the 3rd year of study and finishing with a doctoral dissertation, in line with the views of the European University Association (EUA) (link: https://eua-cde.org/ downloads / publications / 2005_eua_doctoral-programs-european-knowledge-society.pdf). By the amendment of the Law on Scientific Activity and Higher Education in 2003, a Master's degree has been abolished, and the study programme is renamed for the third time in the PhD programme "Biomedicine and Health Sciences". It was the first postgraduate programme in Croatia that followed the ideas of the Bologna process, introduced the European Credits Transfer System and followed the development of synergies between the European Higher Education Area and the European Research Area. In co-operation with the rectorate of the University of Zagreb, this study anticipated the direct demands of the 2003 Berlin Ministerial Conference and from the outset defined PhD programmes as the responsibility of the university and its faculties to provide students with knowledge, skills and competences for independent scientific work (i.e., neither as the introduction to research nor as its crowning achievement).

The School of Medicine has significantly contributed to the development and harmonization of PhD programmes in Europe and has clearly defined rules for initiating and approving PhD programmes in

accordance with international agreements. According to the documents adopted at the two ORPHEUS (Organisation for PhD Education in Biomedicine and Health Sciences in the European System) conferences held in Zagreb (The Declaration of the European Conference on Harmonisation of PhD Programmes in Medicine and Health Sciences in 2004 and Guidelines for Organization of PhD Programs in Biomedicine and Health Sciences in 2005) the first European standards were established that later developed into the Common Standards / Best Practices document by ORPHEUS, the European Association of Medical Schools (AMSE) and the World Medical Association (WFME). The School of Medicine hosted the annual AMSE 2009 Conference which produced the AMSE - Zagreb Declaration on the Role of the Medical School in Postgraduate Education. In summary, the School of Medicine was one of the leading forces in the development of the Bologna Process at the level of doctoral studies not only in Croatia, but also in Europe. As a result of this international initiative of the School, ORPHEUS was founded (the first president from 2006 to 2014 was Professor Zdravko Lacković, now its honorary member), and the headquarters of the organization are today at the School of Medicine in Zagreb. The School of Medicine has significantly contributed to the development and harmonization of PhD programmes in the Republic of Croatia. Immediately after the aforementioned European conferences in 2005 and 2006, in cooperation with the Croatian Academy of Sciences and Arts and its Department of Medical Sciences, meetings of all medical faculties in Croatia were organized precisely for the purpose of harmonizing PhD programmes in Croatia and the European Research Area.

A.2.1.1. Justifiability of starting the new doctoral study with regard to existence of similar doctoral studies at the University of Zagreb

This re-evaluation of the oldest PhD programme of the University of Zagreb and the Republic of Croatia is carried out following an international evaluation conducted in November 2016. At the University of Zagreb, this is the only and the most comprehensive study in biomedicine and health sciences that is providing organized education for research work in the field of expertise and science, including scientific fields of basic medical science, clinical medicine, public health and health care with relevant scientific branches to physicians and other professionals in the medical and health care system. Following the experience and practice of the leading European and world scientific medical institutions, the School of Medicine is focused on improving translational research and integration of basic, clinical and public health programs, which is in turn reflected in the organization of the PhD programme Biomedicine and Health Sciences. Thus, this PhD programme is clearly distinguished from other programs at the University and similar programs in the Republic of Croatia and the surrounding region. The possibility for such a direction of development of research and science at the School is further facilitated by cooperation with the University Hospital Centre Zagreb (UHC Zagreb) and other clinical and health institutions which are both teaching and research bases of the School of Medicine. All this places the School of Medicine and its PhD programme in a unique position to promote research in biomedicine and healthcare in Croatia. Strategic commitment to translational research was established through the founding of the Centre for Translation and Clinical Research of the School of Medicine and UHC Zagreb, the two branches of the School - the Croatian Institute for Brain Research (CIBR) in the field of neuroscience and the School of Public Health (SPH) "Andrija Štampar" in the field of public health, and two recently established Centres of Research Excellence (CoRE) - CoRE for Reproductive and Regenerative Medicine and CoRE for Basic, Clinical and Translational Neuroscience.

A.2.1.2. Usefulness of the proposed doctoral study with regard to needs of research activities in the public and private sectors, and possibilities of employment upon completion of the study program, including the opinion of 3 organizations related to the labour market (e.g. professional associations, employers and their associations, trade unions, public services) on the appropriateness of planned learning outcomes for the needs of the labour market

The PhD programme Biomedicine and Health Sciences educates scientists and researchers who, at the level of the study program as a whole, acquire specific competences and appropriate measurable learning outcomes in accordance with 8.2 of the Croatian Qualifications Framework (CQF). Students are trained to create, design, implement and adopt the processes of independent and original scientific research as well as the use of these skills and knowledge in solving complex scientific and research problems in the field of biomedicine and healthcare and in interdisciplinary areas. This is in full accordance with the proclaimed ambition of the European Union and the Republic of Croatia to attain the achievements of social and economic objectives by acquiring knowledge (exploration). In this concept of a knowledge-based society doctoral studies have a key role. Accordingly, its role to provide a sufficient number of scientists through doctoral studies is not only used to provide scientific and teaching staff for the needs and the renewal of academic and professional (health) potential, but also to provide a critical mass of scientists in the labour market for the needs of the economy, state administration and the like, which is in accordance with the principles of the Salzburg Declaration (http://www.aic.lv/ace/ace_disk/Bologna/Bolsemin/Salzburg/index.htm).

At a time when a growing number of young scientists and holders of PhD degrees are leaving the country and science and education funding is not following an upward trend, there is a continuing national need to provide financial, material and administrative-legal prerequisites for effective education and employment of the critical mass of doctoral degree holders.

The PhD programme Biomedicine and Health Sciences ensures that the number of holders of doctoral degrees (critical mass) is maintained. It also advances scientific work in the field of biomedicine and health care in the Republic of Croatia by educating holders of doctoral degrees employable in the academic and education sector, leading scientific and professional institutions (university and clinical hospitals, healthcare institutions and institutes), government administration (ministries, republic and county bureaus, agencies), and in the business sector, which requires complex task solving and decision-making using scientific methodology (in the pharmaceutical industry, biotech companies, etc.).

The Science Strategy of the School of Medicine particularly emphasizes the need to launch a human resources policy that will enable the recruitment of doctoral and postdoctoral students in basic (institutes), clinical (hospital) and public health scientific areas. In the context of re-evaluation of PhD programmes, the School of Medicine, as a scientific institution, advocates for the possibility of recruiting young scientists, encouraging their interest in research in Croatia, welcoming Croatian scientists to participate in the PhD programme and mentorship, as well as encouraging the return of Croatian scientists from abroad. The School of Medicine considers this to be its responsibility for the advancement of scientific work in biomedicine, which can enhance the position of science and universities in society and contribute to improving Croatia's competitiveness.

A.2.1.3. Usefulness of the proposed doctoral study with regard to the scientific, cultural, social and economic needs

The usefulness and usability of the PhD programme Biomedicine and Health Sciences with regard to scientific, cultural, social and economic needs is indisputable. First of all, PhD education is different from professional degree or higher degree education since the core activity of the PhD candidate is to carry out original research according to academic standards in order to create new knowledge, while developing research skills and acquiring knowledge. Institutions are increasingly viewing holders of PhD degrees as potential new researchers in academic and scientific environments, as well as researchers outside the academic community, as highly qualified "knowledge workers" that bring added value to the their employers. In this context, there is also increased sector mobility of PhD candidates and young degree

holders corresponding to their career prospects (academic community, industry, education, government, counselling, etc.).

Taking into account the social and economic influences, we live in a time of high technology that requires integration of science and technology with application in different spheres of society, including applied medicine. Conversely, modern medicine itself strongly influences the development of technology, and in turn initiates certain social and economic developments. Examples can be found in the experiences and cooperation of the School of Medicine in Zagreb with other University faculties, such as the development of 3D printer modelling technology, the development of robotic devices and devices for surgical applications, the development of new materials and bone healing techniques, the development of new diagnostic tests based on molecular analyses and bioinformatics, the development of smart medicines, the development of reproductive medicine, resulting in the development of new accompanying technologies (e.g., seed banks and egg cells), etc. The aforementioned technologies are integral parts of research projects at the School of Medicine and are included in this PhD programme.

A number of PhD degree holders will find their place in state institutions responsible for specific scientific and professional activities in biomedicine, health and science, especially in ministries, state agencies, departments and institutes. The activities of these highly educated professionals in their institutions can significantly influence the development of the profession and the implementation of specific measures with direct consequences on social and economic issues (e.g. financing of specific health or scientific programs, undertaking specific preventive public health measures, health care organizations, public health actions, etc.).

In addition to the public sector and state administration, PhD programmes have great potential for recruiting future biomedical and health care scientists in the private sector. This applies in particular to the medical industry in which PhD degree holders can play a key role in research institutes and management, in biotechnology companies and private contracting research companies, as well as in privately held biotech companies (e.g., pharmaceuticals or food production, etc.). So it follows that the proposed PhD programme has the purpose and real potential for realization of scientific, cultural, social and economic needs, including the private sector.

A.2.1.4. Foundation of the proposed study programme on competitive scientific or artistic research, and on new insights, knowledge and skills

In line with the recommendations of the European University Association (2007) (https://eua.eu/resources/publications/615:salzburg-ii-%E2%80%93-recommendations.html) and ORPHEUS (2011) (http:// www.orpheus-med.org/images/stories/documents/ORPHEUS-AMSE-WFME-standards-for-PhD-education.pdf) and in accordance with the Strategy of Education, Science and Technology of the Ministry of Science, Education and Sports of the Republic of Croatia from 2014 (https://mzo.hr/en/strategy-education-science-and-technology) the PhD programme Biomedicine and Health Sciences follows and implements the scientific criteria met by the mentors and teachers of the PhD programme, defines the competences and skills to be adopted by the PhD candidate and the criteria to be fulfilled by the PhD thesis (original contribution to science), all with the aim of improving science as one of fundamental development priorities that can facilitate long-term social stability and economic progress. The programme approaches the European level of competence required for the development of a knowledge-based society at the highest level that allows the present development of science in the Republic of Croatia as a “small” scientific community.

The School of Medicine is recognized and held in high regard for its research achievements in the scientific area of the PhD programme “Biomedicine and Health Sciences”, which is reflected in the scientific work and achievements of teachers and mentors, scientific projects, established scientific centres and research cooperation. The School is particularly focused on improving translational research and integrating basic, clinical and public health programs, which puts the School of Medicine in a unique position in The Republic of Croatia to promote research in biomedicine and health.

More than 370 teachers (40% staff, 60% of title-elected teachers and external associates) take part in the programme. They have published a total of 5,005 papers (average 13/teacher) with a total of 39,575 citations (104/teacher) and with an average teacher h-index of 8.34 (staff 9.53). At the University of Zagreb, the School of Medicine is ranked first by number of published papers (48.6% of all, citation from the thematic issue of the journal mef.hr: Scientific Projects in Biomedicine and Health, July 2016, available at www.unizg.mef.hr). According to the SCOPUS database, almost every fourth scientific article published by scientific institutions in the Republic of Croatia has been authored by the faculty of the School of Medicine in Zagreb. According to the SCOPUS database, 42% of the total scientific production in the Republic of Croatia belongs to the field of biomedicine (all fields). Of these, 48% of all biomedical articles have at least one author from the School of Medicine in Zagreb. In the so-called Leiden list of universities that have published more than 1000 articles in the Web of Science over the past 4 years, the University of Zagreb is ranked 419th out of 938 world universities, and the University of Zagreb School of Medicine is ranked 396 in the field of biomedicine and public health. Out of the approximately 400 scientific articles in the Web of Science database published annually by members of the School of Medicine in Zagreb, about 120 are in the first quartile (Q1), and more than 40 are published in journals with the highest scientific impact (M. Klarica. The role of the University of Zagreb School of Medicine in the development of education, health care, and science in Croatia. Croat Med J. 2018; 59: 185-188).

Majority of the scientific projects at the School of Medicine in the previous periods (2007-2014) were financed by national funding (Ministry of Science and Education of the Republic of Croatia). These are the 25 scientific programmes with a total of 87 projects and 74 individual projects, or a total of 161 projects. The faculty staff were the holders of 4 projects under the Unity Through Knowledge Fund programme, and during the period of the European Research and Innovation Funding Program (FP), the faculty members participated in 6 projects. Within the recent Horizon 2020 programme, the School participates with 4 approved projects. In recent years, the School has been successful in obtaining projects funded by the Croatian Science Foundation (CSF) with a total of 15 projects (in preparation for a dozen more) and a University Support Program (40 grants). In addition, there is a considerable number of other international projects (COST Actions, TEMPUS, EAHC), bilateral interstate projects, etc. Among them are DAAD (Deutcher Akademischer Austauschdienst), a bilateral programme for the exchange of participants in projects between the Republic of Croatia and the Federal Republic of Germany. Within the framework of bilateral cooperation, the School also cooperates with Italian and French scientific and research institutions. In the aforementioned article published in Croat Med J 2018, Table 2, the Dean of the School lists newer and more favourable data as of October 16, 2018. According to the Dean, there were 157 scientific projects at the School of Medicine in Zagreb, out of which six were Horizon 2020 projects (totalling € 21 million), 1 COST project, 4 DAAD projects, 29 CSF projects, one EXPANd project, two BICRO-HAMAG projects, one Adris project and 111 University support projects, not counting the two Centres of Research Excellence projects with HRK 74 million.

The School of Medicine is particularly proud to be the only institution in Croatia to have two appointed scientific Centres of Research Excellence (CoRE) - CoRE for Reproductive and Regenerative Medicine and CoRE for Basic, Clinical and Translational Neuroscience. There is also the Centre for Translational and

Clinical Research at the School of Medicine and the Clinical Hospital Centre Zagreb, established in 2009, which is of particular importance in the transfer of knowledge and technology. It is one of the few national faculties that promote the development of translational sciences. The Centre also has a Research and Technology Transfer Office supporting scientists in writing and implementing research projects and helping transfer knowledge and technology from research laboratories and clinical research to industry, enabling faster and more efficient transfer of results to end users - patients.

The School has its own quality research resources in terms of space, equipment, infrastructure and supporting services in accordance with the requirements of the scientific discipline from which the PhD programme is derived. The PhD programme is carried out at the premises of the School of Medicine, University of Zagreb, clinical and outpatient health institutions in Zagreb and scientific-research institutions (partners) with which the School has entered into a cooperation agreement. In addition to the facilities at the School of Medicine, other facilities are located at its research bases in the health system - two university hospital centres, six clinical hospitals, two health centres and two public health institutes. The School has cooperation agreements with the the Ruđer Bošković Institute, University of Zagreb Faculty of Science, University of Zagreb Faculty of Veterinary Medicine, University of Rijeka Faculty of Food Technology and Biotechnology, University of Split School of Medicine, and University Josip Juraj Strossmayer of Osijek Faculty of Medicine.

A.2.1.5. Innovativeness of the proposed study programme, that is, potential of the proposed study programme for creation of new and relevant knowledge or artistic practices

The postgraduate university (PhD) programme “Biomedicine and Health Sciences” educates scientists and researchers who, at the level of the study programme as a whole, must acquire specific competencies and corresponding measurable learning outcomes.

In this context, the PhD programme “Biomedicine and Health Sciences” is fully aligned with the School's scientific mission and vision, the strategic programme of scientific research at the School, as well as with international standards in the field of PhD programmes (ORPHEUS/AMSE/WFME) (http://www.orpheus-med.org/images/stories/documents/ORPHEUS-AMSE-WFME-standards-for-PhD-education.pdf). The School’s mission in the field of science is to conduct collaborative, innovation-driven research programmes that connect scientists in the fields of basic, clinical and public health sciences, promoting interdisciplinarity and collaborativeness. The School of Medicine strives to create a stimulating intellectual environment, to promote scientific and humanitarian aspects of medical practice, while carrying out scientific research in the framework of international and national projects that result in the advancement of science, application in the teaching process and improvement of health care.

Research and development strategies of the School of Medicine are underpinned by the fundamental lines of performance pursued by the institution and involve the following:

- Culture promotion strategy and quality assurance system
- Study curricula quality strategy
- Student support strategy
- Research work quality development strategy
- IT/communication technologies development and application strategy
- National-scale collaboration development strategy
- International-scale collaboration development strategy
- Infrastructure, business and work organisation development strategy

These strategies of are based on the School's values themselves, which can be summarized as follows:

- competent teachers who are leaders in their scientific and professional areas in the Republic of Croatia and have national, regional and international reputation;
- previous references of the School of Medicine that guarantee a high level of quality in teaching, research and transfer of knowledge into practice;
- a high-quality infrastructural support of the realization of all activities of the School of Medicine

student-centred teaching in line with the agreed principles and standards of international medical education and standards of PhD programmes.

A.2.2. Analysis of the compatibility of the doctoral study with the Research Strategy of the University of Zagreb

The proposed PhD programme is fully in line with the Research Strategy, Technology Transfer and Innovation of the University of Zagreb document (http://www.unizg.hr/fileadmin/rektorat/O_Sveucilistu/Dokumenti_javnost/Dokumenti/Strateski_dokumenti/Izvjesca/Istrazivacka_strategija_verzija.pdf) in which one of the key goals is to improve doctoral education. This applies in particular to increasing the research productivity of young researchers, preparing PhD programmes for different careers after obtaining a PhD (basic medical sciences, clinical medical sciences, public health, industry, public sector) and appointment of young scientists to the University, i.e. the need to redefine the position of assistant professors. The system needs to be arranged to attract a number of international PhD candidates - junior researchers, which is carried out at the School of Medicine through the PhD programme in English.

In the above aspects, the PhD programme "Biomedicine and Health Sciences" is fully aligned with the mission, vision and strategic programme of scientific research of the School of Medicine and the University of Zagreb. The research mission of the School of Medicine consists of the implementation of research programs that are collaborative, focused on innovation and that bring together scientists in the fields of basic, clinical and public health sciences.

The immediate goals of the science strategy that fully correspond to the proclaimed goals of the University are the following:

- to develop and maintain a high level of research work that will enhance the research profile and international reputation of the School;
- to educate future generations of researchers in the field of medicine;
- to create synergies in the fields of science, medicine and technology;
- to facilitate the transition and translation of research findings into clinical and public health practice and collaboration with industry;
- to strengthen the culture of cooperation at national and international level;
- to establish a staff scientific policy;
- to strengthen the high level of research collaboration between biomedical science, clinical research departments and outpatient healthcare institutions;
- to encourage continuous monitoring of public health indicators and their application in the process of improving political decision-making on health and healthcare.

Measures to achieve the goals of the science development strategy at the School of Medicine emphasize the need to initiate a staff scientific policy that will enable the recruitment of young scientists (PhD and postdoctoral students) in basic, clinical and public health fields. In the context of the re-accreditation of

the PhD programme, the School of Medicine, as the responsible scientific institution, advocates the employment of young scientists, stimulating their interest in research and work in Croatia, and encouraging the return of Croatian scientists from abroad. The School considers this its responsibility for the advancement of scientific work in biomedicine, which can influence the better position of science and universities in society and contribute to improving Croatia's competitiveness.

A.2.3. PRIOR EXPERIENCES OF THE PROGRAMME PROPOSER IN IMPLEMENTATION OF DOCTORAL STUDIES

The University of Zagreb School of Medicine is one of the oldest medical schools in this part of Europe, and was the first to establish and carry out postgraduate programmes in accordance to the changing laws and regulations. The first postgraduate programme was introduced in 1947/1948 in public health, with occupational medicine starting in 1949/1950. In short, the School of Medicine has over 70 years of experience in organizing and implementing postgraduate programmes.

Preparations for the establishment of the PhD programme began in a working group led by Prof. Zdravko Lacković in 1996. The programme started in the academic year 1997/1998., due to legal restrictions, first as a master-of-science degree programme called "Biomedicine". From 1999/2000. the programme was called “Medical Sciences”, but was organized with the explicit intention that the continuation (the third year of study) should end with a PhD. With the change of the Act on Scientific Activity and Higher Education in 2003 and the Bologna process, the Master's Degree was abolished, and for the third time the study changed its name to the PhD programme “Biomedicine and Health Sciences”. As already mentioned, it was the first postgraduate programme in the Republic of Croatia implementing the ideas of the Bologna Process and introducing the European Credits Transfer System, and it followed the development of synergy between the European Higher Education Area and the European Research Area. In cooperation with the Rectorate of the University of Zagreb, from its outset this programme anticipated the direct requests of the Ministerial Conference in Berlin in 2003 and prescribed that PhD programme, as the responsibility of the School of Medicine, should provide students with knowledge, skills and competences for independent scientific work. The University of Zagreb School of Medicine is a European leader in the implementation of the Bologna Process at the PhD level. As a result of this international initiative, ORPHEUS was founded (the first president from 2006 to 2014 was Prof. Zdravko Lacković, today its honorary member), and the headquarters of the organization were at the School of Medicine in Zagreb. As a result, the PhD programme Biomedicine and Health Sciences became widely known in Europe, bringing the School closer to the European level of competence required for the development of a knowledge-based society at the highest level, spurring and facilitating the current development of science in the Republic of Croatia.

The School has significantly contributed to the development and harmonization of PhD programmes in Croatia. Immediately after the ORPHEUS European conferences in 2005 and 2006, in cooperation with the Department of Medical Sciences of the Croatian Academy of Sciences and Arts (HAZU), meetings of all medical schools in Croatia were held with the aim to harmonize PhD programmes in Croatia and the European Research Area.

During the last years, several international and external evaluation processes have been carried out at the School, which, among other things, have included the evaluation of the PhD programme “Biomedicine and Health Sciences”:

- The Peer Mission of the European Commission visited the School in 2007 as part of the negotiations for the accession of the Republic of Croatia to the European Union, and in 2012 as part of the monitoring before accession;

- The National Council for Higher Education initiated the School's external evaluation process at the end of 2008 and, on the basis of the Final Report, the Faculty received a work permit in early 2009;
- by the decision of the Agency for Science and Higher Education (ASHE) from 2011, the School of Medicine was selected as one of the three faculties of the University of Zagreb, where an internal and external evaluation of the quality assurance system was carried out according to the ESG guidelines. Based on the final report, in 2013 the Faculty was awarded the ASHE certificate for an efficient, developed and functionally organized quality assurance system;
- The re-accreditation process of the School of Medicine was carried out in 2015. The Final Report states: “Each study programme is defined in accordance with clearly defined learning outcomes and international standards. The institution of higher education has put in place mechanisms to approve, monitor and improve its programmes and qualifications”;
- in addition to the aforementioned processes of international and national quality evaluation of the School of Medicine as a whole, 2013/2014. The PhD Programme Committee of the University of Zagreb conducted the evaluation process for the PhD programme “Biomedicine and Health Sciences”. The International Commission has given the opinion that the PhD programme “Biomedicine and Health Sciences” is eligible for continuation of the programme at the University of Zagreb, but some improvements have been proposed;
- the process of re-accreditation of the PhD programme “Biomedicine and Health Sciences”, conducted by the Agency for Health and Safety in 2016. The International Commission identified examples of good practice in the study, but also made recommendations for improving the quality of study.

A.2.4. INTERNATIONAL RECOGNISABILITY OF THE PROPOSER OF THE DOCTORAL STUDY IN SCIENTIFIC OR ARTISTIC RESEARCH, OR ARTISTIC CREATION

The University of Zagreb School of Medicine is an internationally recognized faculty on several grounds. In particular, two basic points should be emphasized - the School as a driving force for the development of PhD programmes in the Republic of Croatia and a frontrunner of harmonization of PhD programmes in Europe, and the School as a place of quality scientific research activity, which is ultimately manifested by international projects and the number of scientific papers and publications.

The School has contributed significantly to the development and harmonization of PhD programmes in Europe and has clearly established rules for establishing and approving PhD programmes in accordance with international agreements. According to documents adopted at two ORPHEUS conferences held in Zagreb, the first European standards were established, which later evolved into common standards (Standards/Best Practices) by ORPHEUS, the Association of Medical Schools of Europe (AMSE) and the World Federation for Medical Education (WFME). The School hosted the 2009 annual AMSE conference at which the *AMSE - Zagreb Declaration on the Role of the Medical School in Postgraduate Education* was adopted. In short, the School has been the leader in the development of the Bologna process at the PhD level in the European context. As previously already stated, the School was a major force in the establishment of ORPHEUS. Today, ORPHEUS is a large European association with 105 institutional members (faculties / universities) from Europe, several medical colleges from Canada, India, Australia and the United States and four associate members: the British Pharmacological Society, The Federation of European Pharmacologists, EMTRAIN Project and Federation of American Societies for Experimental Biology (FASEB). It is the largest PhD programme association in Europe working to promote and link PhD programmes in biomedical and health research. It also implements the ORPHEUS Evaluation Certificate

and Labelling whose purpose is to assist institutions to reflect on their doctoral training programmes, by providing them with a comprehensive and flexible procedure to assist this process of self-reflection.

In terms of research recognition, the School is strategically focused on improving translational research and integrating basic, clinical and public health programmes. The University Hospital Centre Zagreb and other health care institutions are not only teaching but also research bases of the School of Medicine, which puts the School in a unique position to promote research in biomedicine and health in Croatia.

According to the number of published papers by the University of Zagreb, the School of Medicine is in the first place by the number of published papers (48.6%) (mef.hr: Scientific projects in biomedicine and health, July 2016, available at www.mef.unizg.hr). Regarding international projects and cooperation, the Faculty's teachers were holders of 4 UKF projects, 5 FP6 projects and 6 FP7 European research and innovation funding programmes, and 4 Horizon 2020 projects. In addition, there is a significant number of other international projects (IPA, COST Actions, TEMPUS, EAHC, Michael J. Fox) and bilateral / interstate projects. Among them are the DAAD (Deutcher Akademischer Austauschdienst), a bilateral program for the exchange of participants in projects between the Republic of Croatia and the Federal Republic of Germany. Within the framework of bilateral cooperation, the Faculty also cooperates with Italian and French scientific and research institutions.

The School has numerous international bilateral cooperation agreements with the faculties of renowned world universities, including the American (University of California/San Francisco, Medical College of Wisconsin/Milwaukee, Penn State University, Pennsylvania, University of Georgia College of Public Health, The State University of New Jersey/The Rutgers University, Vanderbilt University/Teneesee, University of Northern Colorado, University of Michigan Medical School, McGill / Montreal, etc.) and several European medical school (Ljubljana, Graz, Moscow, Hamburg, Pécs, Rennes, etc.).

The School is also actively involved in a number of European associations for the promotion of higher education in biomedicine: the Association of Medical Schools of Europe (AMSE), the International Association for Medical Education (AMEE), The European Training Consortium in Public Health & Health Promotion, the Association of Schools of Public Health in the European Region (ASPHER), European Public Health Association (EUPHA), Forum for Public Health in South-East Europe, Organization for PhD Education for Biomedicine & Health in European System (ORPHEUS) and European University Association (EUA).

A.2.5. COMPARABILITY WITH SIMILAR DOCTORAL PROGRAMMES OF HIGHLY RANKED FOREIGN UNIVERSITIES

Various PhD programmes are carried out at European medical schools, a number of which are comparable to this proposed PhD programme, primarily in concept with respect to the scientific and educational components of the study programme. In this context, it should be emphasised once again that the PhD programme at the Zagreb School of Medicine hosted two European conferences on the harmonization of doctoral studies in the field of biomedicine, held in 2004 and 2005. Important documents adopted at these conferences are the so-called Zagreb Declaration, which defines PhD programmes, and the “Zagreb Recommendations on the Organization of Doctoral Studies”. The ORPHEUS - Organisation for PhD Education in Biomedicine and Health Sciences in the European System was founded at the Second Conference, headed by Professor Zdravko Lacković. In 2012, the association published a strategic document entitled “Standards for PhD Education in Biomedical and Health Sciences in Europe - A Proposal from ORPHEUS - AMSE – WFME”. This document proposes a set of standards for PhD programmes and PhD degrees in biomedicine and health sciences. The PhD programme “Biomedicine and Health Sciences” follows the standards set out in that document regarding the structure of the institutions of higher education and the research environment, study outcomes, eligibility criteria, curriculum, mentoring, PhD

thesis proposals, and the evaluation and defence of PhD theses. The definition of a PhD thesis standard is in most cases the assurance of quality PhD education that is internationally accepted.

All this shows the comparability with the programmes of reputable foreign higher education institutions, especially those from the EU, and furthermore that the PhD programme of the School of Medicine at the University of Zagreb has played and still has one of the leading roles in these processes of harmonization in Europe.

A.2.6. REQUIREMENTS FOR ADMISSION TO THE STUDY PROGRAMME

Enrolment quotas are determined on the basis of availability of research, teaching and mentorship capacities. Enrolment quotas are determined by the Council for Postgraduate Programmes based on the proposal of the PhD Programme Coordination Committee. Enrolment in a PhD programme is done on the basis of a public call for applications published in the daily press and on the School's website. The public call for applications to the PhD programme is announced at least one month prior to the start of the courses. Enrolment conditions and selection procedures for students are harmonized with the Zagreb Recommendations of the Second European Conference on the Harmonization of PhD Programmes in Biomedicine and Health Sciences.

The conditions for application are:

- a completed relevant university graduate or university integrated undergraduate and graduate programme in the scientific field of Biomedicine and Health Sciences and related field. Exceptionally, with the explanation and the request, applicants with a completed university graduate programme in other fields of natural, and in the case of public health social sciences, may be admitted;
- a grade point average of at least 3.51 (in the grading system 5-10 or AF grade point average of at least 8.00);
- candidates who have completed integrated undergraduate and graduate programme or graduate programme abroad must undergo a process of academic recognition of a foreign degree of higher education before enrolment (http://www.unizg.hr/homepage/study-at-the-university-of-zagreb/academic-recognition-of-foreign-higher-education-qualifications/)
- a letter of recommendation by potential mentor/s, and a research topic proposal
- additional documentation must be submitted with the application (copies of papers and congress summaries, certificates of indexation of papers and congress review, participation in projects);
- a certificate of proficiency in English language (issued by a foreign language school, or other institutions of higher learning) or Croatian language (for candidates whose native language is not Croatian) must also be enclosed;
- candidates who have completed their undergraduate study abroad are required to submit a decision on academic recognition of a foreign degree of higher education prior to enrolment.

A.2.7. DESCRIPTION OF THE SELECTION OF APPLICANTS WITH A SPECIAL EMPHASIS ON DESCRIPTION OF ADMISSION REQUIREMENTS CRITERIA AND TRANSPARENCY OF THE APPLICANT SELECTION PROCEDURE

Candidates are eligible for admission to the programme:

- if they have been ranked among the top fifty candidates determined by the total number of points based on the grade point average in undergraduate and graduate study, professional and

scientific activity (number and type of published papers, participation in congresses and meetings, participation in projects), as well as on the basis of candidate employment contracts in the system of scientific recruits; and

- if they have successfully passed a structured interview with the PhD Programme Coordination Committee.

The table lists the points by individual criteria used when applying for enrolment and ranking candidates in the academic year 2018/2019.

Grade point average in the undergraduate study	2 points for each decimal point between 3.5 – 4.0; 3 points for each decimal point above 4.0
Graduate thesis	1 point for defended research graduate thesis
English language certificate	B1-B2 level 5 points
	C1-C2 level 20 points
Professional and scientific activity:	
Articles indexed in CC (enclose: list of publications, copies of publications and evidence that the journal is indexed)	first author 40 points, co-author 30 points per paper
Articles indexed in other international indices (enclose: list of publications, copies of publications and evidence that the journal is indexed)	first author 20 points, co-author 15 points per paper
Active participation in international scientific conferences (points awarded for active participation per conference – oral or poster presentation with published abstract; enclose: list of abstracts, copies of abstracts and covers of conference proceedings, i.e. conference programmes which indicate that the conference has been organised by an international or European association (institution) or by at least three countries; if there were multiple presentations at the same conference, please submit only one, the most favourable for the candidate)	2 points per conference or active participation as first author, 1 point as co-author; points are awarded per conference, not per abstract
Active participation in domestic scientific conferences (points awarded for active participation per conference –oral or poster presentation with published abstract; enclose: list of abstracts, copies of abstracts and covers of conference proceedings; if there were multiple presentations at the same conference, please submit only one, the most favourable for the candidate)	1 point per conference or active participation as first author, 0,5 points as co-author; points are awarded per conference, not per abstract
Active participation in a project (enclose: signed contract on employment at the project, signed statement of the leader of the project that the candidate is engaged at the project)	for Croatian Science Foundation and EU Horizon 2020 projects 50 points; for other peer-reviewed

	projects 5 points
Dean’s award for original scientific work (enclose copy of the award)	10 points
Rector’s award for original scientific work (enclose copy of the award)	20 points
Assistant employed by the School of Medicine University of Zagreb or junior researcher on the Croatian Science Foundation project (enclose: copy of the contract)	100 points

The selection of candidates for PhD programme is carried out by a PhD Programme Application Committee consisting of Vice-Dean for Postgraduate Programmes and Director, Deputy Director and Assistant Directors of the PhD Programme. PhD Programme Application Committee awards points to the candidates in accordance with the prescribed criteria (Table). The interview is a structured and mandatory part of the application procedure. There are three basic elements to consider during the interview: a) the research topic proposal and its feasibility with respect to the candidate's circumstances of employment, and the duration of the study (where the research will be conducted, sample assessment / research subjects, materials and methods, hypothesis and aims of research, funding, expected realization, possible difficulties in the realization of the research), b) proposed mentor (competences in relation to the proposed research and in general, previous cooperation with the candidate, expectations, etc.) and c) knowledge and command of the English language. The main goal is to examine and determine the likelihood of the proposed research being completed during the PhD programme.

The Faculty Council makes the decision on the acceptance and enrolment of candidates, which is publicly announced on the School's notice board and website. The decision on acceptance and enrolment of candidates is considered a first instance decision. Candidates whose application for enrolment is not accepted may submit their appeal to the Dean within 15 days from the date of announcement of the decision on the School's notice board and website. The Dean's decision on the appeal is final.

A.2.8. DESCRIPTION OF THE INSTITUTIONAL MANAGEMENT OF THE STUDY

PhD Programme Coordination Committee

PhD Programme Coordination Committee consists of a PhD programme director, his/her deputy and one or more assistants from the ranks of teaching staff with scientific-teaching titles who actively participate in the organisation of the curriculum. The PhD programme director is appointed for a period of three years, and the same person may be re-appointed as a PhD programme director. Programme director, deputy director and director assistants are appointed by the Faculty Council based on the recommendation of the Council for Postgraduate Programmes. PhD programme director organizes the PhD programme and is responsible for the implementation of the curriculum, proposes a plan for implementation of the curriculum, convenes and chairs the meetings of the course leaders of the PhD programme, proposes amendments to the curriculum, and submits annual reports on the courses held at the PhD programme to the Council for Postgraduate Programmes and the Faculty Council

Governing bodies responsible for conducting PhD programmes at the School

1) The Faculty Council, which appoints the PhD programme directors and their deputies; the chairpersons and the members of the boards conducting the PhD programmes; the President and the members of the

Ethics Committee and its working groups; committees for the evaluation of the PhD thesis proposal and for the evaluation and defence of the PhD thesis; mentor and co-mentor of a PhD candidate;

2) The Council for Postgraduate Programmes, which performs the function of the Postgraduate University Study Programmes Council, ensures the equal quality of the teaching plans and curricula of PhD programmes, proposes directors of postgraduate programmes as well as course leaders and in cooperation with boards and committees prepares standards and procedures for the evaluation of postgraduate programmes, evaluates student activities during the PhD programme, determines the ECTS workload of programme contents according to their curricula.

3) The Board for Evaluation of Postgraduate Programmes is a permanent expert committee of the Council for Postgraduate Programmes in charge of coordinating activities and harmonizing standards in designing curricula and evaluation of postgraduate programmes.

4) The Board for Evaluation of Scientific Activity of PhD Candidates is a permanent committee of the Council for Postgraduate Programmes in charge of coordinating activities and harmonizing standards in the process of evaluating the scientific activity of PhD candidates and mentors. The Board evaluates whether the conditions for the public defence of the PhD thesis have been fulfilled, in accordance to the Regulations on PhD Programmes.

5) The Board for PhD Theses and Scientific Degrees harmonizes the criteria and coordinates the activities in the process of attaining the academic degree of doctor of science from the moment of the registration of the PhD thesis proposal up to the public defence of the completed PhD thesis and the graduation ceremony. The Board, in cooperation with the Ethics Committee of the School, carries out the entire procedure of application, evaluation and defence of PhD thesis, and proposes to the Faculty Council the appointment of appropriate committees and the appointment of a mentor and co-mentor of the PhD thesis.

6) The Ethics Committee of the School of Medicine (including the Working Group for Biomedical Research and the Board for Animal Well-being), together with the Board for PhD Theses and Scientific Degrees, participates in the process of academic review, public discussion and the final evaluation of the PhD thesis proposal, using the prescribed combined forms.

The mentor and co-mentor cannot be members of the committees for the evaluation and public discussion of the PhD thesis proposal, nor for the evaluation and defence of the completed PhD thesis. In the procedure of attaining the academic degree of Doctor of Science, the members of the expert committees may not be persons who are related to the PhD candidate (by blood or other close relationship, e.g. parents, grandparents, siblings, spouse) nor persons who share common financial and other material interests with the PhD candidate (e.g. co-authorship or co-ownership of a patent).

A.3. CURRICULUM OF THE DOCTORAL STUDY

A.3.1. DESCRIPTION OF THE STRUCTURE OF THE PROGRAMME OF THE DOCTORAL STUDY

The programme consists of methodological courses (learning research procedures and methods), field-related (elective) courses for the application of scientific-research competences in particular medical fields, and a so-called third-credit group which represents measurable scientific contribution of PhD candidates during their studies. In addition, PhD Day is organised with the aim of improving public awareness of the PhD programmes, facilitating and encouraging the exchange of experience in PhD and mentor research and insight into the quality of PhD candidates' work for everyone involved. The PhD Day includes a one-day public presentation of the ongoing research and preliminary results in the PhD theses of all PhD candidates of the 2nd and 3rd year of the PhD programme. Research progress is presented in the form of poster presentation and abstract in a specially printed publication, while several best abstracts are also selected for oral presentation. Participation in PhD Day awards 4 ECTS credits to each candidate and is considered an integral part of the PhD work-load.

The PhD programme can be attended either full-time or part-time.

Full-time programme is completely research oriented and generally lasts for three years. It can be extended up to a total of five years for justified reasons. After this five-year term, the PhD candidate loses the right to obtain an academic degree of Doctor of Science in that programme. The specified period of five years does not include the temporary suspension of studies for justified reasons.

Part-time programme is intended for candidates who, in addition to their PhD obligations, perform other professional duties during their employment (e.g. clinical work or public health, etc.), and often teaching. Part-time programme is organized to facilitate this as much as possible.

Part-time programme lasts for up to five years. It can be extended up to a total of eight years for justified reasons. After this eight-year term, the PhD candidate loses the right to obtain an academic degree of Doctor of Science in that programme. The specified period of eight years does not include the temporary suspension of studies for justified reasons.

The principal scheme of programme activities and the appertaining student credits is as follows:

First year: methodological courses (12 ECTS), submission of PhD thesis proposal and research work with mentor(s) (28 ECTS), scientific activity (publications, attending conferences, meetings, lectures, etc.) (20 ECTS);

Second year: methodological courses and field-related courses (12 ECTS), PhD Day (4 ETCS), public discussion of the PhD thesis proposal and its acceptance by the Faculty Council, research work with mentor(s) (24 ECTS), scientific activity (publications, attending conferences, meetings, lectures, etc.) (20 ECTS);

Third year: methodological and field-related courses (12 ECTS), PhD Day (4 ECTS), research work with mentor(s), writing and successfully defending the PhD thesis (24 ECTS), scientific activity (publications, attending conferences, meetings, lectures, etc.) (20 ECTS).

A.3.1.1. Methodological courses

Methodological courses are offered during all three years of study with emphasis on the first year. The aim of these courses is to familiarize students with the basics of scientific work as a whole, and the procedures and methods in particular research areas. Although students may not fully learn numerous and very different research methods and procedures by attending these courses, an important goal is to gain knowledge of techniques (e.g. biochemical, molecular or in vitro procedures), some of which will be used as groundwork of their PhD thesis. An additional goal of these subjects is to free students, especially clinicians, from the frequent fear of laboratory methods and procedures and to show them that they would be able to master it. Methodological courses should not consist of more than 30% of lectures on theory, while at least 70% of teaching must be focused on presentation of the methods and practical work. The lesser portion of conventional teaching is compensated by the recommended and compulsory literature. Each of these courses is accompanied by a corresponding reference book prepared by the teachers of the course in question. The courses are, as a rule, organized as integrated and include both preclinical and clinical (or public health) methods of tackling particular problems, since, when it comes to scientific methodology, the boundaries between these areas are narrowing.

A.3.1.2. Field-related courses

The field-related courses aim to introduce scientific knowledge and problems in certain narrower areas of research in the field of biomedicine and health sciences. In addition to extending knowledge, such courses enable students to understand and follow the latest scientific literature on a particular area of research. Field-related courses are offered in all years of the programme, but predominantly after the PhD thesis proposal had already been submitted.

Proposals of new field-oriented courses are accepted and considered at all times and all teachers of the School of Medicine, University of Zagreb are invited to apply with courses in the area of their research. All experts from Croatia or abroad who meet the legal requirements are also welcome to apply. All course proposals are subject to double anonymous scientific peer-review prior to acceptance.

A.3.1.3. Scientific activity

The completion of the organized programme and the one of the conditions for submitting a PhD thesis for assessment is considered to be the day when the PhD candidate fulfilled the requirements of the so-called third-credit group, i.e. his/her scientific activities. The PhD student's scientific activity is valued at 20 ECTS per year (60 ECTS credits in total), and scoring elements include published scientific papers stemming from their PhD research and other papers in the field of research, participation in scientific conferences (abstracts), number of citations, invited lectures on the topic of the PhD thesis and received awards in the field of research. An additional requirement is that the PhD student is the co-author with the mentor or co-mentor of the PhD thesis of a paper that is published (or has been accepted for publication) and that is related to the PhD thesis, that he/she is one of the main authors, and that the paper is published in a peer-reviewed scientific journal in the Web of Science (Core Collection) database.

A.3.2. DESCRIPTION OF THE MANNER OF TRAINING DOCTORAL STUDENTS FOR ACQUISITION OF SCIENTIFIC OR ARTISTIC KNOWLEDGE, EXPERIENCES AND SKILLS THAT WILL ENABLE THEM TO SOLVE COMPLEX SOCIAL AND ECONOMIC PROBLEMS CREATIVELY AND ON THE BASIS OF RESEARCH

The PhD programme aims to enable students to independently conduct original and scientifically relevant research and to critically evaluate the research of others after completing the programme and successfully defending their PhD thesis. Additionally, given the fact that in today's environment, healthcare and biomedical practitioners need to be capable of lifelong learning, the additional goal of the

PhD programme is to further candidates' critical thinking and creative problem solving. The achievement of these goals encourages the use of problem-based learning as part of teaching. These principles include not only the need to dissect a particular problem, but also the acquisition of new knowledge and its practical application in achieving the final results of the research. The aforementioned principles are used in a number of mostly methodological courses carried out as part of the PhD programme, for example in subjects "Structure, methodology and functioning of scientific work 1", "Structure, methodology and functioning of scientific work 2", "Structure, methodology and functioning of scientific work 3: research projects", "Medical statistics 2.1: statistical tools for medical data analysis in planned experimental study design", "Medical statistics 2.2: statistical tools for medical dana analysis in quasi-experimental study design", "Medical statistics 2.3: statistical tools for medical data analysis in observational study design with large samples", "Medical statistics 2.4: statistical tools for medical data analysis in observational study design with small samples", "Genomic approaches in biomedical and translational research", "Proteomics in biomedical research", "Medical informatics methods", and others.

A.3.3. DESCRIPTION OF THE PROGRAMME POTENTIAL FOR TRAINING DOCTORAL STUDENTS FOR AN INDEPENDENT, RESEARCH-BASED AND INTERDISCIPLINARY APPROACH TO PROBLEMS, FOR INDEPENDENT RESEARCH AND FOR CRITICAL EVALUATION OF THE WORK OF OTHERS

According to the "Zagreb Declaration", upon completion of the programme, a Doctor of Science has full competences for continuing scientific research work: knowledge of methodology in the field of biomedical and health sciences, is able to write a research proposal, write and publish a paper in a journal indexed on world bases (Web of Science, Scopus, Medline), is able to present, report and defend research findings in the scientific community and to critically evaluate the scientific work of others. They are eligible for postdoctoral training or employment in any of the institutions collaborating in this PhD programme, at other universities in Croatia as well as in collaborative laboratories in the world, in the public sector, in healthcare, research institutions and scientific-educational institutions.

The Postgraduate University (PhD) Programme Biomedicine and Health Sciences is aimed at acquiring new knowledge and skills that enable independent scientific and research work. This applies in particular to the adoption of new methodologies, from molecular, biological and biochemical methods to genomics and proteomics and other research approaches. In addition, through seminars, practical work and journal clubs, discussion of certain aspects of the research is encouraged, and the possible shortcomings of the published research are critically discussed. Within individual courses, such as "Genomic approaches in biomedical and translational research", candidates are encouraged to develop research proposals that contain elements of the methodology presented within the course, and at the end of the course, presentations of research proposals are shared and discussed by all participants. This encourages the development of critical thinking, how to conduct a constructive debate about the results of scientific research, but also how to defend the conclusions drawn from the research results.

Methodological course "Structure, methodology and functioning of scientific work 3: research projects" is especially important for encouraging independent scientific work of students, since within this course students acquire the knowledge and skills necessary for the preparation and application of scientific projects. Since securing financial resources for conducting research is crucial for independent scientific work, the mentioned subject is central for further independent work of PhD candidates. They are introduced to a variety of research funding instruments as well as educational scholarships to facilitate postdoctoral training. The course also contains a practical part during which candidates have to prepare

their own project proposals according to the exact requirements, which specifically prepares them for the requirements of future independent scientific activity.

Another important aspect of PhD programme is that it is interdisciplinary, manifested through various forms of cooperation between PhD candidates and experts of different profiles. For example, many PhD candidates in the programme are clinicians who use specific laboratory, imaging and other methods in their research, which contributes to gaining new insights and creating new knowledge. The requirement for successful cooperation is knowledge and understanding of both areas, whereby the PhD candidate acquires new competences and skills. Another example is dual mentoring, where two experts from different fields jointly pursue PhD research, which is increasingly needed in the dynamic field of biomedicine today.

A.3.4. DESCRIPTION OF THE PROGRAMME POTENTIAL FOR ACQUISITION OF WORK COMPETENCES, INCLUDING LIST OF COURSES FOR DEVELOPMENT OF GENERIC AND TRANSFER SKILLS

A.3.4.1. Learning outcomes at the programme level

The Biomedicine and Health Sciences PhD programme educates scientists / researchers who, at the level of the PhD programme as a whole, must acquire the following specific competencies and their corresponding, measurable learning outcomes in accordance with 8.2 of the Croatian Qualifications Framework (CROQF):

Competence 1. The individual will be able to devise, design, apply and adopt a process of independent, original scientific research.

The measurable learning outcomes related to this competence are as follows: to create new knowledge (entirely new, complement existing, refute existing) by their own distinctive contribution to research through PhD research, create new methods, invent new approaches, instruments or materials that will move the known boundaries in the field of PhD research.

Competence 2. The individual will be able to systematically understand relevant scientific facts, monitor and understand the latest knowledge in the field of PhD research, systematically develop and adopt state-of-the-art methodology and skills in the scientific field of PhD research, and use the acquired knowledge and skills to solve complex scientific research problems.

The measurable learning outcomes related to this competence are the following: to use advanced, highly specialized knowledge and skills independently so that they can develop their own new ideas, theories, facts and procedures in a field of scientific interest.

Competence 3. The individual will be able to assume professional, ethical and social responsibilities independently, professionally and with academic integrity when planning and conducting scientific research, but also upon completion of the research, which includes taking responsibility for the scientific success and social benefit of the PhD research results.

The measurable learning outcomes related to this competence are as follows: to develop a personal, professional and ethical authority at a level that meets all the requirements required to publish research results in scientific publications with international peer review in the field of PhD research.

Competence 4. The individual will be able to communicate in a socially acceptable manner with individuals and groups of different attitudes and opinions, both within the scientific and academic community and within their own profession and beyond.

The measurable learning outcomes related to this competence are as follows: to build their own acceptable and effective forms and methods of interpersonal communication with individuals and groups

of researchers in the process of collaboration on planning and conducting PhD research, PhD thesis and PhD thesis defence, and peer review publication of scientific papers related to PhD thesis.

A.3.4.2. Learning outcomes at the level of methodological courses

The aim of this group of courses is to introduce PhD candidates to the basics of advanced-level scientific work, but also to procedures and methods in particular research areas.

The learning outcomes of the methodological group of courses as a whole, consistent with the 8.2 CROQF level, are as follows:

- independently present advanced knowledge (facts, theories) that underpins modern scientific methodology (biochemical, morphological, molecular - biological, physiological, immunological, microbiological, neuroscientific, psychological and behavioural, pharmacological, organ system imaging, diagnostic and laboratory, pathophysiological, epidemiological, statistical, etc.) and that will be used in PhD research;
- independently present methodological skills and procedures necessary for planning, selecting, performing (collecting and processing data), standardizing and optimizing the scientific method pertaining to PhD research;
- independently or in a team critically evaluate the results published in a presented scientific article, especially in the light of controlling the trial conditions and the multiple factors affecting the research results before and during the experiment.

Examples of learning outcomes for several methodological courses are as follows:

Biochemical methods in biomedical research: Select the latest laboratory analytical methods and judge the biological variability of the sample. Make conclusions on the impact of pre-analytical procedures on the results of specific laboratory analyses. Make conclusions on the possibility of measuring specific analytics in low concentration ranges.

Gene targeting in mammals: Present advanced knowledge of human disease modelling in mice with genetic techniques, including gene knockout gene disabling procedures. Recognize the application of a particular model with a genetically engineered mouse in their own research.

Statistical analysis of medical data 1: Use statistical software (SAS, JMP, Statistica, R). Perform preparation, input and screening of data for statistical analysis on their own. Assess the strength of the test and sample size independently. Perform descriptive statistics procedures independently. Independently test a hypothesis using parametric and non-parametric methods of statistical testing of hypotheses. Independently perform basic statistical and analytical procedures for qualitative data. Independently perform basic statistical modelling procedures by regression (logistic regression, linear regression, Cox regression). Independently present, interpret and generalize statistical results. Journal Club: Critically evaluate the appropriateness of the statistical procedures applied in selected publications.

Epidemiologic methods in research: Plan to conduct epidemiological research. Hypothesize epidemiological research. Calculate and explain frequency and connectivity measures. Make conclusions on possible errors of epidemiological and clinical research (accidental, systematic error; major types of confounding, selection, lead-time, drop-out, etc.). Assess the impact of applied health interventions or health technology on treatment outcomes. Make conclusions on reliability, effectiveness of tests or diagnostic methods. Detect an epidemic based on epidemiological analyses or sudden grouping of events. Make a proposal to address ethical issues specific to epidemiology (research approval, notification, consent, data protection and treatment of newly diagnosed patients).

A.3.4.3. Learning outcomes at the level of field-related courses

Field-related courses aim to introduce students to specific problems and provide the knowledge needed for research in particular narrower branches of biomedicine and health sciences. By incorporating advanced knowledge, extended beyond the graduate and postgraduate specialist level of learning, such courses must enable the student to follow with understanding the latest scientific literature in their field of research. Therefore, critical judgment about selected scientific papers (the Journal Club) is an essential part of field-related courses.

Examples of learning outcomes for several field-related courses in the clinical, preclinical, and public health subjects are as follows:

Experimental oncology: malignant diseases as persistent oxidative stress: Present the latest knowledge on the pathophysiology of oxidative stress and its importance in oncology. Evaluate the purpose and application of specific biochemical methods for the determination of markers of oxidative stress and lipid peroxidation in tumours. Discuss scientific and practical aspects of complementary forms of oncology therapy based on scientific approach. Independently judge a selected scientific article in the subject area (Journal Club).

Pharmacogenomics: Present advanced knowledge in the field. Assess the importance of certain pharmacogenetic analyses. Interpret genotyping findings and apply them to create algorithms and select the optimal drug and dose for the individual patient.

Proteomics in biomedical research: Present advanced knowledge of the fundamentals of mass spectrometer and other tools in proteomic research. Know the capabilities, advantages and limitations of proteomic methods in specific research questions.

Disorders of adrenal gland: Present advanced knowledge of diagnostic treatment of patients with adrenal tumours, diagnosis and treatment of congenital adrenal hyperplasia, hormone replacement therapy for patients with adrenal insufficiency, options for surgical and pharmaceutical treatments of adenomas, pheochromocytomas and adrenal cortical carcinomas. Comment on diagnostic and therapeutic dilemmas in adrenal disease and independently devise possible solutions based on patient presentation. Make critical judgments on your chosen issue through the Journal Club discussion.

A.3.4.4. Generic skills

Generic/transferable skills and competences that can be acquired through the PhD programme Biomedicine and Health Sciences and used outside the scientific, academic and/or clinical careers are:

- solving complex problems using critical thinking, judgment, generalization, synthesis and integration of ideas; know the meaning of evaluation and systematic procedures in the process of evaluating results, projects and programmes;
- ability to transfer and operationalise new technologies and new ideas;
- ability to manage project tasks;
- organisational and leadership skills;
- ability to teach others.

The PhD programme has a number of required courses which develop generic skills of the candidates. They are required to attend three blocks of methodological courses in which they become acquainted with:

- advanced knowledge and skills of scientific communication, both verbally and in writing, in Croatian and English languages;
- advanced statistical methods needed to carry out their research;
- designing research and experiments and the relationship between design and statistics;
- importance of a well-defined hypothesis, the role of pilot studies and preliminary data;
- advanced knowledge of databases, computer and automated data collection;
- specifics of working with human subjects in research;
- specifics of working with experimental animals in research
- basics of intellectual property and patent filing.

A.3.5. POTENTIAL OF THE STUDY FOR ESTABLISHING COOPERATION WITH OTHER HIGHER EDUCATION INSTITUTIONS, RESEARCH INSTITUTES, AND PRIVATE AND PUBLIC BUSINESS SECTORS

The PhD programme “Biomedicine and Health Sciences” features participation of numerous external associates in teaching, which include not only employees of other institutions of higher learning, but also scientists employed at scientific institutes and employees of the public sector active in the field of biomedicine, health care and pharmaceuticals.

In addition to teachers at the University of Zagreb School of Medicine, the PhD programme teachers are employees of several other faculties of the University of Zagreb, including the School of Dental Medicine, Faculty of Pharmacy and Biochemistry and Faculty of Veterinary Medicine (biomedical area), Faculty of Science, Faculty of Education and Rehabilitation Sciences, Faculty of Electrical Engineering and Computing, Catholic Faculty of Theology and Faculty of Law. Also, employees of universities in Rijeka, Split and Osijek participate in a smaller part of the programme. Among the leading scientific institutes, scientists employed at the Rudjer Boskovic Institute, the Institute of Anthropology, the Institute for Medical Research and Occupational Health and the Institute for Physics participate in the teaching and scientific research of the PhD programmes. Finally, employees of all major clinical centres and hospitals that house the clinics of the School of Medicine in Zagreb – University hospital centre Zagreb, University hospital centre "Sestre milosrdnice", University hospital Merkur, University hospital Sveti Duh and University hospital Dubrava are course leaders and lecturers at the PhD programme. Finally, employees of private research companies such as Fidelta (Galapagos, Zagreb) and pharmaceutical companies like Pliva (Teva Pharmaceutical, Zagreb) also participate in the teaching and research components of the programme.

Additional attention is also paid to technology transfer and the financing of scientific research, which is discussed in the three compulsory methodological courses in the series "Structure, methodology and functioning of scientific work". All of the above shows significant openness to collaboration, but more importantly, it provides PhD candidates with new in-depth insights into translational approaches and the pathway of medicine, which could ultimately contribute to the development of new research programmes and significant scientific and economic results.

A.3.6. REQUIREMENTS FOR STUDENTS' ADVANCING DURING THE STUDY

In addition to fulfilling the obligations of the curriculum, the requirements for advancing through the programme are as follows: a) submitting a PhD thesis proposal and choosing mentor(s) for enrolment in

the second year of study; and b) accepted PhD thesis proposal and mentor by the Faculty Council for enrolment in the third year of study.

A.3.7. REQUIREMENTS FOR APPROVING THE PROPOSAL OF THE DOCTORAL DISSERTATION

All PhD candidates may, immediately upon obtaining the student status in a PhD programme, and at the latest before the expiry of the first study year of a PhD programme, submit to the Board for PhD Theses and Scientific Degrees a request to initiate the procedure for attaining the academic degree of doctor of science and to submit a PhD thesis proposal on the prescribed forms of the Board for PhD Theses and Scientific Degrees (form DR.SC.-01A), with the relevant additional documentation. The obligatory part of the additional documentation is a statement of the PhD candidate that he/she did not register an identical PhD thesis proposal at another PhD programme of the University of Zagreb or any other university. The appropriate, completed forms are also submitted simultaneously to the School's Ethics Committee which is included in the process of review of the PhD thesis proposal. All scientific research on or with humans or animals must be conducted in accordance with regulations, with the approval of the School's Ethics Committee, as well as the institution where the research is conducted, and with consent of all research subjects individually, if they are able to give them, or their proxies or legal representatives.

The Board for PhD Theses and Scientific Degrees proposes the appointment of a committee to evaluate the PhD thesis proposal and to select a mentor to the Faculty Council. The proposed mentor and co-mentor cannot be members of the committees for the evaluation and public discussion of the PhD thesis proposal, nor for the evaluation and defence of the completed PhD thesis.

A PhD thesis proposal is presented at a public discussion. The schedule of public discussions on the PhD thesis proposals is announced on the notice board of the PhD programme and on the School's website. Proposed mentor(s), PhD candidate, members of the expert committee, a representative of the Ethics Committee, members of the Board for PhD Theses and Scientific Degrees and other interested members of the academic community participate in the public discussion. All comments and suggestions made during a public discussion are recorded in the form provided for that purpose (form DR.SC.-02), which also includes the final evaluation report on the PhD thesis proposal. The Committee for the evaluation of the PhD thesis proposal in its report to the Board for PhD Theses and Scientific Degrees proposes either: a) acceptance of the PhD thesis proposal with an explicit statement of the original scientific or artistic contribution achieved, or b) correction of the PhD thesis proposal and the final evaluation, or c) rejection of the PhD thesis proposal.

The report from the public discussion and the evaluation of the PhD thesis proposal (DR.SC.-02 form) as well as the corrected PhD thesis proposal (form DR.SC.-01B) are submitted to the Board for PhD Theses and Scientific Degrees no later than six months after the public discussion. If the report and the corrected PhD thesis proposal are not submitted within the prescribed deadline, the public discussion of the PhD thesis proposal is repeated. Based on the final report from the public discussion (form DR.SC.-02) and the submitted corrected PhD thesis proposal (form DR.SC.-01B), the Board for PhD Theses and Scientific Degrees submits to the Faculty Council a proposal to accept or reject the PhD thesis proposal and to appoint a mentor (and a co-mentor, if necessary).

The Faculty Council must make a statement on the motion by the Committee for the evaluation of the PhD thesis proposal and for proposing a mentor until the enrolment of the PhD candidate in the fifth semester, that is, the third study year.

A.3.8. REQUIREMENTS FOR COMPLETION OF STUDY

The PhD programme is completed by passing all exams, mandatory participation in PhD Days, positively evaluated scientific activity and the preparation and public defence of the PhD thesis. Before submitting the completed PhD thesis, the PhD candidate is obliged to submit the evidence that they have fulfilled all the conditions from the curriculum, which include the following:

a) that they have accumulated 60 ECTS credits on the basis of their scientific activity during the PhD programme, and

b) that they are a co-author with the mentor or co-mentor of the PhD thesis of a paper that is published (or has been accepted for publication) and that is related to the PhD thesis, that they are one of the main authors, and that the paper is published in a peer-reviewed scientific journal in the Web of Science (Core Collection) database.

A PhD candidate initiates the process of evaluating the completed PhD thesis by submitting unbound copies of the PhD thesis, digital copy of the PhD thesis, declaration of originality and a written approval and opinion of the mentor on the conducted research and the original scientific contribution achieved, in the School's Registration office with the designation: "For the Board for PhD Theses and Scientific Degrees". If the mentor does not wish to give their approval, the PhD candidate is obliged to inform the Board for PhD Theses and Scientific Degrees about this, who will then send a letter to the mentor that they are to make a written statement with the explanation about it within 15 days. In both cases, the mentor's explanation is provided to the members of the committee for the evaluation of the completed PhD thesis, and they take it into consideration during their evaluation.

On the basis of a motion of the Board for PhD Theses and Scientific Degrees, the Faculty Council appoints a committee for evaluation of the completed PhD thesis, which has three or five members, at least one member of whom cannot teach at the PhD programme or is not an employee of the School, and is preferably an employee of another Croatian or foreign university or related institution. Neither the mentor nor the co-mentor can be a member of the committee for the evaluation of the completed PhD thesis.

The members of the committee for the evaluation of the completed PhD thesis and all others who ex officio (or as associates on the project) have access to the completed PhD thesis are obliged to treat all data and insights from the PhD thesis as confidential until its publication, in order to protect the scientific contribution of the PhD thesis and intellectual property rights.

The committee for the evaluation of the completed PhD thesis is obliged to submit a written and signed report with the evaluation of the PhD thesis within two months from its appointment to the Board for PhD Theses and Scientific Degrees. Each member of the committee has the right to submit a separate opinion and evaluation.

The Committee for the evaluation of the completed PhD thesis may propose in its report:

a) that the PhD thesis is accepted;

b) to return the PhD thesis to be corrected and completed and then resubmitted for evaluation within three to six months (depending on the planned scope of the corrections), or

c) to reject the PhD thesis, after which the PhD candidate loses the right to attain the academic degree of doctor of science in that PhD programme.

Explanation is an obligatory part of the report.

Before submitting the completed PhD thesis, the PhD candidate is obliged to submit the evidence that they have fulfilled all the conditions from the curriculum to the Board for PhD Theses and Scientific Degrees and the Board for Evaluation of Scientific Activity of PhD Candidates, which include the following:

a) that they have accumulated 60 ECTS credits on the basis of their scientific activity during the PhD programme, and

b) that they are a co-author with the mentor or co-mentor of the PhD thesis of a paper that is published (or has been accepted for publication) and that is related to the PhD thesis, that they are one of the main authors, and that the paper is published in a peer-reviewed scientific journal in the Web of Science (Core Collection) database.

The committee for the public defence of the completed PhD thesis may have the same members as the committee for the evaluation of the completed PhD thesis, but the Faculty Council is obliged to appoint one substitute member based on the proposal of the Board for PhD Theses and Scientific Degrees.

PhD candidates whose PhD thesis proposal and mentor have been accepted are obliged, no later than five years from the date of acceptance of the PhD thesis proposal, and no earlier than 15 days from the date of the PhD thesis acceptance by the University of Zagreb Senate, to initiate the process of evaluation of the completed PhD thesis. Upon expiry of this deadline, the PhD candidate must regulate their student status and is obliged to initiate the procedure of re-evaluation of the PhD thesis proposal, according to the conditions valid at the time of re-submission of the PhD thesis proposal.

A.3.8.2. Procedure of the public defence of a completed PhD thesis

The defence of the PhD thesis is public. The committee for the public defence of the completed PhD thesis makes the evaluation after the defence. Defence scores can be *rite*, *cum laude*, *magna cum laude* and *summa cum laude*. The score is made by a majority vote of the members of the committee for the public defence of the completed PhD thesis. Public defence of the completed PhD thesis can be held only once.

A.3.8.3. Publishing and storage of a completed PhD thesis

The PhD thesis is published in its entirety on the website of the School's Central Medical Library, no later than one month after the successful completion of the public defence. In exceptional situations, on the basis of a written explanation and with the approval of the Board for PhD Theses and Scientific Degrees, publication on the School’s website may be postponed for up to two years.

The hard copy of the PhD thesis is stored in the School's Central Medical Library, the National and University Library and in the archives of the University of Zagreb. The PhD thesis must be published on the public university website of the National and University Library at the latest one month after the defence.

A.3.9. LIST OF REQUIRED AND ELECTIVE COURSES/MODULES, WITH NAMES OF COURSE TEACHERS, NUMBER OF INSTRUCTION HOURS AND APPOINTED ECTS (IF ANY)

REQUIRED COURSES:	COURSE TEACHERS	L	S	P	ECTS
Structure, methodology and functioning of scientific work 1	Assoc. Prof. Ana Borovečki, Prof. Zdravko Lacković, Prof. Jelka Petrak	12	10	6	**4.0**

Structure, methodology and functioning of scientific work 2	Prof. Vladimir Trkulja, Assoc. Prof. Donatella Verbanac, Prof. Zdravko Lacković	14	13	11	**5.0**
Structure, methodology and functioning of scientific work 3: research projects	Assoc. Prof. Fran Borovečki, Prof. Srećko Gajović	3	3	6	**2.0**
Statistical analysis of medical data 1	Prof. Zdenko Sonicki, Prof. Davor Ivanković	12	6	20	**5.0**
Medical statistics 2.1: statistical tools for medical data analysis in planned experimental study design	Prof. Mirjana Kujundžić Tiljak	0	4	12	**2.0**
Medical statistics 2.2: statistical tools for medical dana analysis in quasi-experimental study design	Prof. Mirjana Kujundžić Tiljak	0	4	12	**2.0**
Medical statistics 2.3: statistical tools for medical data analysis in observational study design with large samples	Prof. Zdenko Sonicki, Prof. Davor Ivanković	0	4	12	**2.0**
Medical statistics 2.4: statistical tools for medical data analysis in observational study design with small samples	Prof. Zdenko Sonicki, Prof. Davor Ivanković	0	4	12	**2.0**

ELECTIVE COURSES:

BASIC MEDICAL SCIENCE METHODOLOGY COURSES:	**COURSE TEACHERS**	L	S	P	**ECTS**
Biochemical methods in biomedical research	Prof. Jasna Lovrić, Assoc. Prof. Dunja Rogić	5	9	21	**5.0**
Methods of molecular biology in medicine	Prof. Florijana Bulić Jakuš, Prof. Jadranka Sertić	14	5	19	**5.0**
Genomic approaches in biomedical and translational research	Assoc. Prof. Fran Borovečki	11	5	9	**4.0**
Electrophysiological techniques in medical research	Assoc. Prof. Diana Delić Brkljačić, Assoc. Prof. Aleksandra Dugandžić	12	0	16	**4.0**
Morphological research methods in biomedical sciences	Prof. Srećko Gajović, Prof. Boris Brkljačić	7	5	11	**3.0**
Proteomics in biomedical research	Prof. Lovorka Grgurević	4	2	14	**3.0**
Laboratory animals in biomedical research	Ranko Stojković, PhD, research advisor	14	4	2	**3.0**

Methods of investigation *in vivo* and *in vitro*	Prof. Drago Batinić, Prof. Dora Višnjić	3	4	13	**3.0**
CLINICAL MEDICAL SCIENCE METHODOLOGY COURSES:	**COURSE TEACHERS**	L	S	P	**ECTS**
Telemedicine	Prof. Davor Miličić, Assoc. Prof. Mirza Žižak	6	12	2	**3.0**
Research methods of psychological functions and behaviour	Prof. Rudolf Gregurek, Prof. Alma Mihaljević Peleš	1	1	14	**2.0**
Characteristics of clinical medical research	Assoc. Prof. Robert Likić	3	8	4	**2.0**
PUBLIC HEALTH METHODOLOGY COURSES:	**COURSE TEACHERS**	L	S	P	**ECTS**
Epidemiologic methods in research	Assoc. Prof. Nataša Antoljak, Prof. Zvonko Šošić	10	13	9	**4.0**
Research and evaluation methods of health interventions	Prof. Stjepan Orešković	3	2	15	**3.0**
GENERAL METHODOLOGY COURSES:	**COURSE TEACHERS**	L	S	P	**ECTS**
Medical informatics methods	Assist. Prof. Kristina Fišter, Prof. Jadranka Božikov	6	0	14	**3.0**
Evidence-based medicine	Prof. Ratko Matijević, Prof. Žarko Alfirević	5	5	10	**3.0**
FIELD-ORIENTED COURSES:	**COURSE TEACHERS**	L	S	P	**ECTS**
Medical image analysis	Assist. Prof. Stanko Težak	15	15	0	**4.5**
Disorders of adrenal gland	Prof. Darko Kaštelan	3	7	5	**2.0**
Gene targeting in mammals	Prof. Srećko Gajović	2	5	3	**1.5**
Diabetes and pregnancy	Prof. Josip Đelmiš, Prof. Marina Ivanišević	10	4	5	**2.5**
Diagnostic and treatment of female urinary incontinence	Prof. Slavko Orešković	8	4	3	**2.5**

Experimental oncology: malignant diseases as persistent oxidative stress	Prof. Neven Žarković	15	3	2	**3.0**
Endocrine tumours of gastrointestinal tract and pancreas	Assist. Prof. Maja Cigrovski-Berković, Prof. Vanja Zjačić-Rotkvić	7	3	2	**1.5**
Epigenetics	Prof. Maja Vlahović, Assist. Prof. Nino Sinčić	5	10	2	**2.5**
Pharmacogenomics	Prof. Nada Božina	2	11	7	**3.0**
Physiology and biochemistry of the uterus in pregnancy and labour	Prof. Marina Ivanišević	9	6	4	**3.0**
Genotoxicological research of exposure to physical and chemical mutagens in working and living environment	Aleksandra Fučić, PhD, research advisor	2	10	0	**1.5**
Human reproduction	Prof. Dinka Pavičić Baldani, Prof. Davor Ježek, Tarek El-Toukhy, research associate	9	3	4	**2.5**
Immunocytokines	Assist. Prof. Alenka Gagro, Assist. Prof. Tomislav Kelava	3	9	4	**2.5**
Immunological recognition	Prof. Drago Batinić	10	8	0	**2.5**
Biomaterial infections	Prof. Jasmina Vraneš	4	14	0	**2.5**
Isotransplantation of mammalian organ primordia	Prof. Gordana Jurić-Lekić	5	4	8	**2.5**
How to become a neuron?	Prof. Srećko Gajović	0	14	7	**3.0**
Hand surgery	Assoc. Prof. Rado Žic	13	6	6	**3.5**
Surgical therapy of pituitary tumours	Prof. Darko Kaštelan, Assist. Prof. Tomislav Sajko	2	8	5	**2.0**
Clinical neuropharmacology	Prof. Maja Relja	10	10	10	**4.5**
Clinical nutrition	Prof. Sanja Kolaček, Iva Hojsak, PhD, senior research associate	12	6	14	**5.0**

Clinical psychopharmacology	Prof. Miro Jakovljević	15	6	4	**3.5**
Clinical laboratory diagnostics of malignant melanoma with special reference to molecular-biological diagnosis assessment	Prof. Mirna Šitum	12	0	0	**2.0**
Bone morphogenetic proteins in regeneration of bone and cartilage	Prof. Slobodan Vukičević	9	1	4	**2.0**
Laboratory approach to transplantation of haematopoietic stem cells	Prof. Drago Batinić	7	10	7	**3.5**
Medical anthropology	Prof. Pavao Rudan, Assist. Prof. Natalija Novokmet	4	16	0	**3.0**
Mechanisms of allergic reactions	Assist. Prof. Alenka Gagro	4	11	3	**2.5**
Metabolic syndrome	Prof. Lea Smirčić-Duvnjak	4	7	2	**2.0**
Methods in molecular oncology	Prof. Sonja Levanat Assist. Prof. Vesna Musani	2	4	20	**4.0**
Microvascular tissue transfer	Assoc. Prof. Rado Žic	7	5	13	**3.5**
Molecular genetics of aging and carcinogenesis	Prof. Ivica Rubelj	20	0	0	**3.0**
Molecular haematology	Prof. Rajko Kušec	16	5	5	**3.5**
Molecular oncology – insight into new technologies	Assoc. Prof. Koraljka Gall-Trošelj	10	4	3	**2.5**
Molecular aspect of lymphocyte development	Prof. Mariastefania Antica	10	5	6	**3.0**
Molecular and biochemical approach to genetic disorders	Prof. Jadranka Sertić	4	4	7	**2.5**
Molecular genetics and pharmacogenetics of gastrointestinal tumours	Prof. Sanja Kapitanović	16	4	0	**3.0**
Multiresistant bacteria associated with nosocomial infections	Prof. Branka Bedenić	5	8	12	**3.5**

Advanced ultrasonography in gastroenterology and hepatology	Assoc. Prof. Ivica Grgurević, Prof. Boris Brkljačić	4	14	2	**2.5**
Genomic instability	Prof. Nives Pećina-Šlaus	6	4	5	**2.5**
Neurobiology of aging	Prof. Goran Šimić	4	12	4	**3.0**
Fetal and neonatal neurophysiology, fetal behaviour	Prof. Aida Salihagić-Kadić, Prof. Vlatka Mejaški Bošnjak	6	9	8	**3.0**
Movement disorders	Prof. Maja Relja	10	8	7	**3.5**
Selected chapters of epileptology of developmental age	Prof. Nina Barišić	6	19	7	**4.5**
Selected topics in transplantation immunology	Prof. Danka Grčević, Assoc. Prof. Nataša Kovačić	4	9	6	**3.0**
Selected animal models of psychiatric disorders	Prof. Nela Pivac	4	4	4	**1.5**
Knowledge discovery in medical domains	Dragan Gamberger, PhD, research advisor Prof. Zdenko Sonicki	6	14	10	**4.5**
Pathophysiology of the brain and the CSF	Prof. Marijan Klarica	12	6	2	**3.0**
Pathogenesis of infective diseases	Prof. Jasmina Vraneš	6	20	4	**4.5**
Use of doppler ultrasound in research and diagnosis of diseases of blood vessels	Prof. Boris Brkljačić, Assist. Prof. Gordana Ivanac	7	8	5	**3.0**
Understanding bone metabolism – basic science in clinical practice	Prof. Vesna Kušec	8	8	1	**2.5**
Human developmental neurobiology	Prof. Ivica Kostović, Prof. Miloš Judaš	8	8	2	**2.5**
Reproduction and workplace	Assist. Prof. Milan Milošević, Prof. Jadranka Mustajbegović	7	7	0	**2.0**
Synaptic plasticity and mind	Prof. Ivica Kostović	2	10	2	**2.0**

Liaison and consultative psychiatry	Prof. Rudolf Gregurek	17	10	3	**4.5**
Translational medicine - from disease to gene	Oliver Vugrek, PhD, senior research advisor	4	2	4	**1.5**
Kidney transplantation	Ivica Mokos, PhD, research advisor	6	18	6	**4.5**
Liver transplantation	Assoc. Prof. Tajana Filipec Kanižaj, Prof. Leonardo Patrlj	6	12	4	**3.0**
Liver transplantation in children	Prof. Jurica Vuković	5	8	5	**3.0**
The role of immunogenetics in transplantation	Assist. Prof. Renata Žunec	10	6	6	**3.0**
Mental health service management	Prof. Rudolf Gregurek	6	6	4	**2.5**
Health and public health risks management in crisis situations	Assoc. Prof. Iskra Alexandra Nola, Prof. Stjepan Orešković	6	5	14	**4.0**
Viral hepatitis	Prof. Marko Duvnjak, Prof. Adriana Vince	10	15	0	**3.5**
Scientific approach to transfusion treatment	Prof. Jasna Mesarić	2	14	0	**2.5**

*L = lectures; S = seminars; P = practical work;

The principal scheme of course enrolment is as follows:

First year: 12 ECTS worth of courses: (REQUIRED) Structure, methodology and functioning of scientific work 1 (4 ECTS) + choice of elective methodological courses (8 ECTS in total)

Second year: 12 ECTS worth of courses: (REQUIRED) Structure, methodology and functioning of scientific work 2 (5 ECTS) and Statistical analysis of medical data 1 (5 ECTS) + choice of elective methodological and field-oriented courses (2 ECTS in total);

Third year: 12 ECTS worth of courses: (REQUIRED) Structure, methodology and functioning of scientific work 3: research projects (2 ECTS) and one of Medical statistics 2 courses, depending on study design (2 ECTS) + choice of elective methodological and field-oriented courses (8 ECTS in total).

A.3.10. POSSIBILITY OF IMPLEMENTATION OF THE DOCTORAL STUDY PROGRAMME IN ENGLISH OR SOME OTHER LANGUAGE AND LIST OF COURSES THAT MAY BE OFFERED IN THAT LANGUAGE

PhD programme "Biomedicine and Health Sciences" in English enrolled its first students in the academic year 2007/2008 and was the first such programme in the Republic of Croatia. The requirement for

enrolment is foreign citizenship, and the teaching is entirely conducted in English. The courses, structure of the programme and the teaching process are fully equivalent to its Croatian counterpart. There is, however, a difference in the teaching schedule itself. Namely, this program promotes the so-called “sandwich” model of teaching and course attendance. Candidates have an intensive month and a half of courses in each academic year. This allows for shorter absences from their workplace and residence in another country. In addition, candidates can have an additional mentor not affiliated with the School of Medicine in Zagreb, one from their home country. This type of mentoring is encouraged since it facilitates that the candidates conduct at least part of their research, if not all, in their home country. This discourages future brain drain for their countries and enables growth of its research and scientific capacities leading to “brain gain”.

According to January 2019 data, a total of 66 applicants from Kosovo, Bosnia and Herzegovina, Canada, Macedonia, Italy and Ukraine enrolled in the programme. Forty-eight of them have finished the courses and are now working on their PhD thesis whose proposals had been successfully accepted. The first graduation ceremony of the two PhD candidates that earned their highest academic title with the completion of the Biomedicine and Health Sciences PhD programme was held on April 1, 2015. So far, 16 students have completed their studies and received the title of Doctor of Science.

There are 48 co-mentors who are foreign nationals. The largest number of those is from Kosovo (18), less from Slovenia (8), the USA (5), Macedonia (3) and Bosnia and Herzegovina, Germany and France (2 comments each). One co-mentor each is from Spain, the Netherlands, Hungary, Belgium, Poland, the Czech Republic, Albania and Canada.

A.3.11. CRITERIA AND REQUIREMENTS FOR ENROLLING IN COURSES/MODULES FROM OTHER DOCTORAL STUDIES

Teaching contents (courses) with final exams at PhD programmes of other medical schools in the Republic of Croatia are as a rule rated in the same way as PhD courses at the School of Medicine, University of Zagreb. However, it is first assessed whether these courses are equivalent to those of this programme. To do this, the candidates must provide course content, course leaders’ CVs and other information relevant to the evaluation (similar to the "diploma addendum" in European education terminology).

The same applies to courses taken at PhD programmes of other recognized faculties at home or abroad. In doing so, however, things that are further evaluated are: the enrolment criteria and completion criteria for these programmes, and the inclusion criteria of the course (do courses undergo a review and what kind). Additionally, organized PhD and postdoctoral training with proficiency exams at renowned, non-profit scientific institutes can be also taken into account.

A.3.12. DESCRIPTION OF THE SYSTEM OF ADVISING AND GUIDING DOCTORAL STUDENTS THROUGH THE DOCTORAL STUDY, APPOINTMENT OF STUDY ADVISOR IN THE PROCESS OF ENROLMENT INTO THE DOCTORAL STUDY, AND HIS/HER DUTIES

A three-member study committee is appointed to each PhD candidate enrolled to guide, advise and work with the candidate throughout their studies up to their PhD thesis defence. The study committee consists of the PhD mentor, a head of the department where PhD research is being conducted and one other member of the faculty.

A.3.13. RIGHTS AND OBLIGATIONS OF DOCTORAL STUDENTS, MENTORS AND STUDY PROVIDERS

A.3.13.1. Rights and obligations of PhD candidates

Prior to the enrolment in the first semester of a PhD programme, selected applicants are required to sign a contract on mutual rights and obligations. The contract contains provisions on:

a) the contracting parties,

b) PhD candidate's financial obligations,

c) statements by the PhD candidates and their mentors about the understanding of the commitments they made and their rights and responsibilities during the PhD programme,

d) the obligations regarding enrolment and completion of the programme, and

e) other rights and obligations relevant to the completion of the programme.

PhD candidates have the right and obligation to attend all forms of classes, and they are required to attend at least 80% of classes, of which records are kept. The provisions of the Regulations of Graduate Programmes of the School shall be appropriately applied to the questions of attendance, records of classes, taking of examinations and the obligations of PhD candidates.

Upon completion of each study year, PhD candidates are required to certify the year of study. PhD candidates who fail to enrol in the next year of study are required to submit a prescribed form of temporary suspension of studies; otherwise they lose their student status.

A PhD candidate has the right to freely and independently choose a mentor (and a potential co-mentor) for their PhD thesis. A PhD candidate has the right to change the mentor appointed to supervise the accepted PhD thesis proposal once and only for justifiable reasons. A PhD candidate has the right to submit a request to terminate work on the previously accepted PhD thesis proposal once, and to request evaluation and acceptance of a new PhD thesis proposal with the appointment of the same or a new mentor. A PhD candidate may be granted several requests to terminate work on the previously accepted PhD thesis proposal for justified reasons resulting from unforeseen events, extraordinary events and events that could not be prevented, eliminated or avoided.

A PhD candidate is obliged to submit an annual report on their progress to the Council for Postgraduate Programmes. In addition, PhD candidates are required to submit a certificate that in each academic year they spent at least 160 working hours within the laboratory or clinical department or the Referral Centre of the Ministry of Health of the Republic of Croatia or other relevant research dealing with the topic related to the PhD thesis.

A.3.13.1. Rights and obligations of mentors

A person may be appointed as a mentor of the PhD thesis if they are an employee of the School holding a scientific-teaching degree and position or is elected in the title scientific-teaching degree at the School, provided that they are an active researcher in the field for which the PhD thesis is proposed, as evidenced by the simultaneous fulfilment of the following two criteria:

a) that during the past 5 years they have been a leader of a national or international project or an active contributor to such a project, and

b) have published at least 3 internationally recognized papers relevant to the research of their PhD candidate's PhD thesis (as evidenced by data from the Web of Science, SCI expanded and SSCI) over the past five years.

Professors emerita and full members of the Croatian Academy for Arts and Sciences can be mentors of PhD theses, if they are active leaders of research projects.

In order to ensure the full and comprehensive development and education of PhD candidates, to enhance interdisciplinary research, the quality of research and the mobility of young researchers, and the quality of PhD theses, the School may appoint a co-mentor if necessary.

Prior to taking up the first mentorship, the prospective mentor must attend a workshop for mentors organized by the University, the School or recognized international schools, or co-mentor one PhD thesis. A person may mentor up to five PhD candidates at a time.

The mentor and co-mentor are obliged to supervise the PhD candidate during the preparation of their PhD thesis, to monitor the quality of their PhD thesis, to encourage the publication of their papers and to enable them to participate fully in scientific research projects.

Primary responsibility for publishing papers co-authored by the PhD candidate is the responsibility of the mentor, who is expected to maintain at least average scientific productivity during the writing of PhD thesis, which means publishing at least one paper per year in internationally peer-reviewed journals cited in WoS, SCI expanded and SSCI.

The mentor is obliged to submit annual reports on the PhD candidate’s progress to the Council for Postgraduate Programmes.

A.3.13.3. Rights and obligations of the programme provider

The School of Medicine has established working bodies responsible for the realization and quality assurance of the PhD programme in accordance with the approved curriculum.

PhD Programme Coordination Committee consists of a PhD programme director and one or more assistants from the ranks of teaching staff with scientific-teaching titles who actively participate in the organization of the curriculum. A PhD programme director organizes the PhD programme and is responsible for the implementation of the curriculum, proposes a plan for implementation of the curriculum, convenes and chairs the meetings of the course leaders, proposes amendments to the curriculum, submits annual reports on the courses held and performs other tasks in accordance with laws and regulations. Assistants to the PhD programme director participate in the application process and selection of candidates for admission, in the development of the implementation of the curriculum, in the organization and realization of PhD Day, take care of teaching materials and teaching aids, submit reports on the courses held and conduct programme surveys.

The Board for PhD Theses and Scientific Degrees a permanent expert committee of the Faculty Council, which harmonizes the criteria and coordinates the activities in the process of attaining the academic degree of doctor of science from the moment of the registration of the PhD thesis proposal up to the public defence of the completed PhD thesis and the graduation ceremony.

The Board for Evaluation of Postgraduate Programmes is a permanent expert committee of the Council for Postgraduate Programmes, which coordinates activities and harmonizes standards in the process of designing curricula and evaluating postgraduate programmes.

The Board for Evaluation of Scientific Activity of PhD Candidates is a permanent expert committee of the Council for Postgraduate Programmes, which coordinates the activities and harmonizes the criteria in the process of evaluating the scientific activity of PhD candidates and mentors and evaluates whether the conditions for the public defence of the PhD thesis have been fulfilled.

The Council for Postgraduate Programmes decides on all issues regarding postgraduate programmes within the scope of its jurisdiction, on the basis of proposals from its working bodies (boards). This applies in particular to the harmonization of the quality of the programme curriculum, the analysis and quality

assurance of the PhD programme, the determination of the ECTS points according to the curriculum and the evaluation of the scientific activity of PhD candidates during their studies.

A.3.14. COST OF THE STUDY PROGRAMME PER DOCTORAL STUDENT

The sources of funds for the PhD programme are:

- state scholarships (today the Croatian Science Foundation - HRZZ),
- places of employment of PhD candidates (health care institutions, pharmaceutical industry, agencies, etc.) ,
- PhD candidates themselves (self-financing), and
- School of Medicine's own funds.

Funds raised for the purpose of PhD programme are allocated clearly and in a manner that ensures the maintenance and improvement of PhD education. Since the total costs are paid in part from the revenues of the state budget of the Republic of Croatia, the city and county budgets, the revenues from scientific projects and courses, the total costs are deducted from the costs paid from own revenues (source 31). Tuition revenues are recorded in accordance with the financial rules of the users of the state budget, but refer to the academic year, not the financial year. For this reason, the revenue from the tuition fees of one academic year is transferred to the revenue of another financial year. Accordingly, the costs of a doctoral degree are also charged to two financial years.

The total costs of the School, paid out of own resources, include expenses for spending according to the following basic categories.

Remuneration for work outside the prescribed standard consists of:

- salaries and wages for teaching and non-teaching staff beyond the prescribed standard;
- payment of work wages to external associates through work contracts;
- overtime pay for all employees;
- costs of hiring new employees (agency fees).

Operating cost and other material costs

The total amount of annual operating cost is calculated by using the financial data for source 31 (revenues from own sources) less the amounts of salaries and wages paid from own source revenues.

The School of Medicine systematically allocates funds from tuition and other own resources to cover the **costs related to scientific research** and the preparation of PhD thesis:

- proper disposal of waste (radioactive, infectious, toxic, animal origin, etc.) resulting from research;
- training of personnel to handle hazardous materials and devices, obtaining licenses to work with experimental animals and the like;
- procurement of appropriate protective equipment;
- renovation of housing and equipment for experimental animals;
- servicing and maintenance of capital, medium and small lab equipment;
- construction and infrastructure renovation of laboratories;

- procurement of chemicals used by a number of research groups (alcohol, acids, alkalis, formalin, liquid nitrogen, etc.);
- publishing in open access journals, poster design, organization of PhD Day, assistance in attending symposia and congresses and the like.

Costs to third parties relate to:

- the University of Zagreb Development Fund and its components;
- candidate compensation for the Croatian Medical Chamber duties.

The tuition fees for the PhD programme “Biomedicine and Health Sciences” at the School of Medicine are calculated on the basis of the costs of staff, external associates, operating costs of the School, procurement and maintenance of equipment, premises and administrative costs resulting from the overall running of the School.

On the basis of cost parameters, number of candidates per year of PhD programme, number of hours of teaching and engaged teaching and administrative staff, an amount of HRK 70,000.00 to 77,000.00 was determined, which would be sufficient to cover the cost of the programme per candidate. The exact amount, on an annual basis, depends on the number of candidates enrolled, the number and academic rank of teachers hired, and the proportion of the cost of pursuing a PhD degree in the total cost. The exact amount of programme costs in 2017 and 2018 is listed in the table below.

PhD PROGRAMME COSTS		
	2017	2018
Operating expenses		
office material	193,803.50	196,990.92
computers and IT material	261,712.89	298,480.14
promotional services	278,465.15	562,653.18
literature	301,609.14	284,368.30
maintenance (cleaning agents, sanitary fittings and accessories) washing services, freight forwarding	657,024.30	554,165.63
small inventory	98,129.14	64,858.21
clothing	122,334.67	57,807.78
teaching assistants	426,501.50	452,921.95
building and equipment maintenance	2,280,690.43	1,109,401.20
animal care	194,126.40	193,092.84
laboratory supplies and chemicals	319,637.50	221,256.99
pest control, chimney maintenance	17,202.36	20,707.78
total	5,151,236.98	4,016,704.92
Expenditure on non-financial assets		
renovation of laboratories and lecture halls	97,954.25	364,833.19
computer equipment	241,251.90	429,208.08
office equipment	197,374.58	305,351.08
maintenance equipment	56,283.56	78,495.75
laboratory equipment	76,055.50	123,795.00
teaching equipment	272,626.68	151,560.56
books	44,014.54	61,369.62

total	985,561.01	1,514,613.28
Employee expenses		
salaries	9,977,283.47	10,532,649.07
wages for PhD programme	726,342.47	
total	10,703,625.94	10,532,649.07
Utilities		
electricity, gas, water, waste disposal	364,214.26	316,091.16
total expenditure	17,204,638.19	16,380,058.44
cost per student	77,150.84	70,909.34

Due to the extremely difficult economic situation in recent years, to the strategic need for medical staff and motivating young doctors to continue their scientific education in the Republic of Croatia and to contribute to the development of the medical profession with their expertise and knowledge, the amount of tuition fees for PhD programmes was set at HRK 20,000.00 per year.

A.4. METHODS OF MONITORING QUALITY OF THE DOCTORAL STUDY

A.4.1. LIST OF QUALITY INDICATORS SUCH AS SCIENTIFIC OR ARTISTIC PRODUCTION OF TEACHERS AND DOCTORAL STUDENTS, QUALITY OF INSTRUCTION, RELEVANCE AND QUALITY OF DOCTORAL DISSERTATIONS, STATISTICAL DATA ON DURATION OF STUDY, STATISTICAL DATA ON THE NUMBERS OF NEW HOLDERS OF DOCTORAL DEGREES IN RELATION TO THE NUMBERS OF DOCTORAL STUDENTS ANNUALLY, INTERNATIONAL COOPERATION REALIZED, EMPLOYABILITY OF NEW HOLDERS OF DOCTORAL DEGREES

A.4.1.1. Scientific production of teachers and PhD candidates

The mentor is required to guide the PhD candidate, monitor the quality of their work, encourage the publication of papers and enable full participation in scientific research projects. Therefore, monitoring and evaluating the quality of a mentor's scientific performance is monitored directly and indirectly.

The quality of mentors is directly monitored on the basis of their scientific production. The mentor must have a scientific or scientific-teaching title of at least a research associate or assistant professor and be an active researcher in the field in which the PhD thesis is prepared. This is substantiated in two ways: (1) that the mentor is a leader or associate on an active domestic or international project and (2) that the mentor has previous scientific achievements (publications) in the last five years, or that they have published at least five papers in journals cited in WoS or at least one paper in Quartile 1 (Q1) or Quartile 2 (Q2). Good selection of mentors is shown by data for the 5-year period 2011/2012 - 2015/2016: 685 active and potential mentors (who have the conditions for mentors but did not have a PhD candidate in the last five years) published 10,774 papers (15.7 per mentor), with an average number of citations of these papers 117.6, with an average h-index of these papers 3.7 and an average h-index of mentors 9.5. The data for the last academic year (2017-2018) also clearly show the high productivity of mentors and their PhD candidates (Table 4.1.).

Table 4.1. Indicators of scientific production of mentors for the academic year 2017/2018.

Number of mentors with PhD candidates	Number of mentors whose PhD candidates defended their thesis successfully	Number of published scientific papers by mentors	Number of published scientific papers by mentors in international journals	Number of mentors' publications with their PhD candidates
303	75	834	689	126

Indirectly, the quality of the mentor is also monitored by the quality of scientific work, that is, by scientific activity of PhD candidates. Data on scientific activity and productivity of PhD candidates for the 2011/2012 - 2015/2016 is also satisfactory. Of the 543 PhD students for whom data was collected, 174 completed their studies and received the title of Doctor of Science. During their studies, these PhDs published, on average, 1.33 papers from their PhD thesis, with a citation number of 1234 and an average number of citations of 5.3.

A.4.1.2. Quality of teaching

The quality of teaching and the content of the courses is assessed by a student survey, which has been continuously conducted since the beginning of the programme. PhD Programme Coordination Committee has the right and duty to periodically attend classes. For smaller courses, an anonymous survey is conducted when submitting the exam grade slips to the student office. The students are familiar with the

e-mail addresses of the members of the PhD Programme Coordination Committee and the Vice-dean for Postgraduate Programmes, and have the opportunity to express their complaints without any consequences to them. Warranted complaints are reported to the course leaders, with the name of the plaintiff not given without their consent. In order to ensure continuity of the teaching part of the PhD programme, all retired course leaders must have co-leaders, and course leaders who are foreign nationals should, as a rule, have co-leaders resident in the Republic of Croatia (commonly from the University of Zagreb School of Medicine).

According to the annual academic report for the year 2017/2018, PhD candidates of the PhD programme “Biomedicine and Health Sciences” from all three study years (n = 348) evaluated the study with a score of 4.06 (expressed as median). Teachers' quality was rated 4.21, availability of teaching materials (scripts, website, articles, handouts) 4.1, usefulness of teaching materials 4.03, lectures 4.1, seminars 4.07, and practical work 4.06. Graduate study organization rating was 4.03. In general, PhD candidates praised the quality and accessibility of their teachers, interesting presentations and valuable practical knowledge they gained in conducting their own research. There were complaints about occasional unannounced absences of teachers, some lengthy theoretical lectures and lack of teaching materials in some courses.

The concrete suggestions of the PhD candidates for improving the quality of teaching were: to introduce even more practical work, to communicate more clearly with the students, and to explain more clearly what is expected in the exams from individual PhD courses.

A.4.1.3. Relevance and quality of PhD theses

The quality of the PhD theses is reflected in the quality and number of scientific publications resulting from the research during the PhD programme. Data on scientific productivity of PhD candidates in 2011/2012 - 2015/2016 speak in favour of satisfactory scientific productivity. Out of the total number of PhD candidates who graduated and/or were still studying during this period, data was collected for 58.5% of PhD candidates. The number of papers resulting from the narrow topic of their PhD thesis was 362, with a citation number of 1534 and an average number of citations of 2.83. It should be borne in mind that some doctoral candidates had only just their PhD thesis proposals accepted. For those who completed the programme during this period and received the title Doctor of Science (n=174), data shows that they, on average, published 231 papers in the narrower topic of the thesis, on average 1.33, with the number of citations 1234 and the average number of citations 5.3.

A.4.1.4. Statistical indicators of study duration

The median of the duration of studies from enrolment to drafting and defending a PhD thesis for students who have completed their doctoral studies and received their PhD in 2009/2010 was 7.0 years and in 2017/2018 it was 7.74 years. Compared to the developed EU member states, which have a full-time PhD duration of 3 - 4 years, this is still a rather long period. This is understandable, however, since our PhD candidates are largely part-time clinicians and therefore study duration is longer than in developed EU member states. Specifically, a number of part-time PhD candidates take study leave because of other obligations (specialization, scholarships, maternity leave, etc.), which negatively affect the statistical indicators of the duration of studies.

A.4.1.5. Statistical indicators of the annual number of new PhDs in relation to the number of PhD candidates

According to the indicators of the last analysis for the academic year 2017/2018, there were a total of 210 students enrolled in all academic years, not counting PhD candidates who had taken classes

and were in the process of writing their PhD thesis. Most students (almost 95%) enrolled in part-time study, and only 5% of students studied full-time. 64 students enrolled in the first year of study, and in the same year 65 PhD candidates defended their PhD thesis. So, in 2017/2018, more doctoral students defended their PhD thesis than were enrolled in the same academic year.

A.4.1.6. International collaboration

The international collaboration of the School of Medicine reflects the dynamic process of internationalization in the field of higher education. Internationalization of the School is one of the proactive strategies of change and improvement of academic life and work in the specific conditions of educational and professional scientific work in the field of biomedicine and health sciences.

The School is active in the following areas of its strategic orientation and level of development of international collaboration and international relations:

- development of PhD programmes in accordance with the Bologna Process, and in particular in accordance with international documents in the field;
- affirmation of ECTS credit system as a unique form of quantification and evaluation of teaching and student workload;
- increasing the number of exchange students and strengthening the intercultural and educational component through European mobility programs, bilateral inter-faculty and inter-university agreements and the organization of thematic summer schools;
- increasing the number of teachers in exchange and as well as their more active participation in longer study visits, scientific and professional fellowships;
- increasing the competitiveness of scientists from the medical field in the area of project applications for the European Union (Seventh Framework Program and Horizon 2020) and maintaining the continuity of international scientific, infrastructural and organizational projects initiated;
- stronger participation, especially by junior researchers, in Marie Curie fellowship programs that encourage the mobility of scientists and researchers at foreign Incoming/Outgoing International Fellowships;
- defining areas of scientific excellence with the aim to integrate Croatian biomedical orientation institutions more effectively into the European Research Area (ERA);
- expansion of the Office for International Relations as a place of coordination and systematic monitoring of all forms of international action and a centre that generates monitoring mechanisms within the quality improvement system in the field of internationalization;
- maintaining the current level and enhancing ongoing cooperation with the central Office for International Relations at the University of Zagreb, with even greater coordination in the exchange of information on international programs and initiatives.

At the international level, the School as an institution, its organizational units, departments and individuals, foster collaboration with domestic and international institutions in the field of biomedicine and health sciences. This kind of cooperation takes place through bilateral inter-faculty and inter-university agreements, participation in the work of academic networks and organizations, and participation in scientific meetings and their organization.

Table 4.2. Review of the International Collaboration of the School of Medicine

Bilateral university agreements	University of Vienna, the Medical University of Graz, Bratislava University, the University of Hamburg, the University of Toronto, the University of Thessalonica, the University of Padua
Bilateral faculty agreements	Schools of Medicine: Graz, Pecs, Timisoara, the Russian State Medical University, Moscow, Hamburg, Ljubljana, Mostar, Skopje, Tetovo, Tuzla, Podgorica, Prishtina, Tirana, Ecole Nationale de la Santé Publique - Rennes, South Carelia Polytechnic Finland, Kent, McGill, University of Michigan Medical School, University of California San Francisco, University of Northern Colorado, University of Georgia College of Medicine, Medical College of South Carolina, Medical College of Wisconsin, Penn State University
Regional initiatives	Cooperation on harmonisation of medical curricula in South-East Europe organized by the German Rectors' Conference and coordination of the School of Medicine in Hamburg; the Medical Competence Network of SEE Medical Schools (coordinator: The Medical University in Graz) Multilateral agreements: ETC-PHHP (European Training Consortium in Public Health and Health Promotion – cooperation with 10 universities in the European Union) and PH-SEE (Public Health in South Eastern Europe – cooperation with 16 universities in South and South-East Europe); South East Europe Workplace Academy (SEEWA)
TEMPUS programmes	Universities in Ghent, Pécs, Vienna, Hamburg, Maribor, Osijek, Split and Prishtina
Participation in international and regional associations and programmes	Association of Medical Schools of Europe (AMSE) , International Association for Medical Education (AMEE), The European Training Consortium in Public Health & Health Promotion, Association of Schools of Public Health in the European Region (ASPHER), European Public Health Association (EUPHA), Forum for Public Health in South-East Europe, Organization for PhD Education for Biomedicine & Health in European System (ORPHEUS), European University Association (EUA)
Joint BA/MA or PhD programmes	PhD programme in the field of biomedicine and health sciences with the University of Ljubljana, Master programme Leadership and Management in Health Sciences, postgraduate programme in ultrasound diagnostics in gynaecology with Hamad Medical Corporation Qatar
Summer schools	Federation of European Neuroscience Societies Summer School, Motovun International Summer School of Public Health, European Medical Students Association (EMSA) Summer School in Emergency Medicine Dubrovnik
Professional courses	International courses in cardiology, diabetology, neurology, ENT, occupational medicine and other areas of medicine, and courses run by the European Molecular Biology Organization (EMBO), courses within the longitudinal studies Basic Medical Skills organized according to the European Resuscitation Council
Scholarships for mobility of students and teaching staff	Lions Club Austria: Medical Students Beyond Frontiers, Katolische Kliniken in Kleve Kreis scholarships, Josip Matovinovic Clinical Fellowship, University of Michigan Medical School, Ann Arbor, Michigan
FP6 programmes	*Diagnosis of acute HCV infection* *Genome-based therapeutic drugs for depression* *Eating-out habits*

	European Leukemianet *Congenital disorders of glycosylation*
FP7 programmes	*See Annex: International Projects*
COST action	*See Annex: International Projects*
Other international research programmes	National Institute of Health: Fogarty International Research Collaboration Award: Endemic Nephropathy (State University of New York), DAAD collaborative project: *Experimental models of Alzheimer's disease and cerebral diabetes related disorders* DAAD PhD scholarship: *Brian insulin system alterations in probable experimental models of sporadic Alzheimer's disease*

In the context of international educational and scientific projects and programs, the Office for International Relations plays an important role. The Office exchanges information and coordinates affairs with the School's Centre for Translational and Clinical Research, which is primarily responsible for disseminating information on international projects and reporting them. The Office for International Relations also systematically provides information on opportunities, encourages and facilitates mobility of PhD candidates.

The School is in agreement with the European Charter and the Code for Researchers and implements its principles and charters. Understanding of the Charter and the Code is a compulsory part of curriculum for PhD candidates.

Institutional support for PhD candidates to participate in international scientific conferences is described in Chapter 3. Each year, the best PhD candidates at PhD Day participate in the International Doctoral Competition in Prague.

All PhD theses in the PhD programme in English are written in English. PhD candidates in the PhD programme in Croatian also have this opportunity, if they have a foreign co-mentor.

PhD candidates can write their PhD theses using the Scandinavian model, in accordance with the provisions of the Regulations on PhD Programmes of the University and the School.

The School has a number of international collaboration agreements which include joint scientific-research and exchange of teachers and PhD candidates. Examples of selected international agreements are:

- Collaboration Agreement between the School of Medicine and the University of Ljubljana, Slovenia,
- Collaboration Agreement between the School of Medicine and the University of Pecs, Hungary,
- Collaboration Agreement between the School of Medicine and the Medical College of Wisconsin, Milwaukee, USA,
- Collaboration Agreement between the School of Medicine and the University of California, San Francisco, USA,
- Collaboration Agreement between the School of Medicine and the University of Georgia College of Public Health, USA.

A.4.1.7. Employability of Doctors of Science

The contextual framework, primarily the economic situation in the Republic of Croatia, affects the low funding of approved projects of scientifically productive leading researchers, which in turn makes it difficult to recruit an adequate number of young researchers on top-rated projects. This also affects the lack of funds to procure equipment and conduct research. There are also insufficient initiatives to send postdoctoral fellows to compulsory residency at internationally respected institutions.

The described situation also affects the employment of young scientists at the School. The School of Medicine, as a responsible scientific institution, is committed to recruitment of young scientists, stimulating interest in research and stay in Croatia, and the return of Croatian scientists from abroad. This is a prerequisite for improving scientific work in biomedicine, which can influence the better position of science and universities in society and contribute to improving Croatia's competitiveness.

Most PhD candidates are employed in healthcare full-time, which prevents them from studying full-time. This challenge can only be resolved by common agreement between the governing ministries responsible for science, higher education and health and subsequent changes in legislation. This would strengthen the high level of research collaboration between basic biomedical sciences and clinical research departments.

PhD candidates find employment in the healthcare system, in the scientific and academic sphere, at the University and the School of Medicine, in the pharmaceutical and biotechnology industry, in government agencies and bodies whose activities are in the field of health, biomedicine, science and technology.

A.4.2. DESCRIPTION OF THE METHOD OF PARTICIPATION BY DOCTORAL STUDENTS IN PROCEDURES OF EVALUATION OF THE PROGRAMME OF THE DOCTORAL STUDY

The mechanisms for quality control and monitoring of the PhD programme and mentoring are at the level of the University of Zagreb and at the School level. At the University level, PhD students are required to submit an Annual Doctoral Progress Report (university form DR.SC-04) each academic year, in which the PhD student evaluates not only the programme and teachers in the previous year but also the mentor. At the School level, an additional form of PhD programme evaluation has been established, consisting of exit surveys for completed PhDs. This survey is being conducted from the academic year 2018/2019.

A.4.3. PROCEDURES FOR MONITORING AND IMPROVING THE QUALITY OF THE DOCTORAL STUDY PROGRAMME, AS WELL AS FOR MONITORING OF SUCCESS IN IMPLEMENTATION OF THE DOCTORAL STUDY (PROCEDURES OF EVALUATION AND SELF-EVALUATION – ANNUAL SELF-EVALUATION OF THE STUDY PROGRAMME, ANNUAL SELF-EVALUATION OF DOCTORAL STUDENTS, REVISION AND IMPROVEMENT OF THE DOCTORAL STUDY IN ACCORDANCE WITH QUALITY MONITORING RESULTS AND RESULTS OF SELF-EVALUATION OF THE PARTICIPANTS IN THE DOCTORAL PROGRAMME)

PROCEDURES FOR EVALUATION AND SELF-EVALUATION

In order to establish and implement a quality system, the Faculty has selected a model based on the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).

The bodies responsible for ensuring the quality system at the leadership and decision-making levels are the Dean, the Dean's Council and the Faculty Council. The bodies responsible for ensuring the quality system at the advisory level are the Boards and Committees of the School. Management and responsibility for quality assurance at the executive and performance levels is put on the heads of departments, course councils, programme coordinators and heads of the School's administrative and professional services. The Quality Promotion Committee is a special body of the School and its members

are representatives of internal and external stakeholders. The responsibilities and tasks of the Committee include an advisory role and coordination in promoting the quality culture and quality assurance of the School, in collaboration with the Higher Education Agency, the Board and the Office of Quality of the University of Zagreb and international partners.

Several international and external evaluation processes have been carried out at the School of Medicine in recent years, which have included the evaluation of the PhD programme “Biomedicine and Health Sciences” as well:

- The "Peer" mission of the European Commission visited the School in 2007 as part of the negotiations for Croatia's accession to the European Union and in 2012 as part of monitoring Croatia before joining. Both missions evaluated all levels of education: graduate, postgraduate and specialist training.
- The National Council for Higher Education had initiated the School's external evaluation process at the end of 2008 and, on the basis of the Final Report, the School received a work permit in early 2009. The Final Report states the following (citation): “The evaluation of the School of Medicine at the University of Zagreb has shown that this higher education institution meets all the requirements and standards in the educational, scientific and professional field. The School of Medicine is a well-organized institution that is constantly improving its teaching activity, raising the quality of its programmes and investing in its scientific recognition. ”
- Following the decision of the Agency for Science and Higher Education from 2011, the School of Medicine was selected as one of the three faculties of the University of Zagreb, where an internal and external evaluation of the quality assurance system was carried out according to the ESG guidelines. Based on the final report, in 2013, the School received the Agency’s certificate for an efficient, developed and functionally organized quality assurance system.
- The re-accreditation process of the School of Medicine was conducted in 2015. The Final Report states: “Each study program is defined in accordance with clearly defined learning outcomes and international standards. The institution of higher education has established mechanisms for approving, monitoring and improving its programs and qualifications. Rating: Fully implemented."

According to the Regulations on PhD Programmes of the School of Medicine, the Council for Postgraduate Programmes, and its Board for Evaluation of Postgraduate Programmes are responsible for coordinating and harmonizing benchmarks in the postgraduate programme design and evaluation process. The Council and its boards keep records and oversee the PhD research activities and other study responsibilities of PhD candidates, assisted by the Board for PhD Theses and Scientific Degrees. In addition, the Council, with the assistance and support of the Board for PhD Theses and Scientific Degrees, monitors the mentors’ workload and performance. The monitoring criteria include the scientific production of teachers and PhD candidates, the relevance and quality of PhD programmes, indicators of study duration, the annual number of new PhDs in relation to the number of PhD candidates and the achieved international collaboration.

The Faculty has several mechanisms for continuous and periodic quality monitoring and assessment of the PhD programme.

Annual report of mentors and PhD candidates

In accordance to the decision of the Faculty Council of the School of Medicine of 24 September, 2013, and the Regulations on PhD Programmes, University of Zagreb, submission of annual reports on the work of mentors and PhD candidates is a condition for enrolment in the subsequent year of the PhD programme.

The PhD candidates submit the report on the work through the online database of PhD candidates - OBAD to the University of Zagreb, at: http://doktorski.unizg.hr/obad via the form DR.SC.-04.

The mentors submit their work report via the form DR.SC.-05, but not through OBAD. The mentor submits the signed report in writing to the Department for Postgraduate Programmes prior to enrolment in the next year.

Assessment of the PhD candidate's scientific activity

During the programme, candidates are required to accumulate a certain number of ECTS points related to their scientific activity. From the academic year 2016/2017 a new on-line scoring system was introduced in which students input their publications and track their scientific activities, and PhD Programme Coordination Committee oversees and evaluates their scientific activity through this system. Between October 2017 and February 2019, the scientific activity of 94 PhD candidates was evaluated, 9 of which were evaluated negatively.

School survey on teaching quality

After each course, the quality evaluation is conducted electronically through the survey available at https://tinyurl.com/y7agh69x. This internal anonymous and voluntary survey is conducted sporadically, and the results show that PhD candidates rate teachers' quality and teaching performance very highly (described previously). At the end of the academic year, the results are communicated to the leaders of each individual course as well as to the members of the PhD Programme Coordination Committee.

Exit Survey

Evaluation of the entire programme based on an exit survey (attachment 2.3) is being conducted electronically for the purpose of the PhD programme evaluation from the academic year 2018/2019.

PhD Day

Since 2012, the School of Medicine in Zagreb has been organizing a PhD Day every year as a compulsory part of the PhD Programme Biomedicine and Health Sciences. The aim of this event is to adapt the programme to European standards as much as possible. The purpose of holding a day like this is to improve the accessibility of the public to PhD programmes, facilitate and encourage the exchange of research experiences of PhD candidates and mentors, and insight into the quality of work of PhD candidates for all interested parties. The gathering is attended by representatives of the University of Zagreb Rectorate, guests from other faculties and universities, and sometimes by distinguished representatives of the Croatian Academy of Sciences and Arts and the Ministry of Science and Education.

It is a one-day public presentation of preliminary research results within PhD theses of the second and third year of study in the form of displayed poster presentations and abstracts published in a special publication. In addition, the programme coordinators select some of the best abstracts for oral presentation. Preparation and participation in the PhD Day grants 4 ECTS credits to each active participant. It is also an excellent opportunity to evaluate research activity of the programme and an occasion to evaluate the quality of the programme itself. At the same time, it is also a transferable skills workshop: poster design, presentation and public defence of work in front of colleagues, teachers and guests as well as overview and analysis of peer research.

A.6.2. LIST OF SCIENTIFIC, ARTISTIC AND DEVELOPMENTAL PROJECTS ON WHICH THE PROGRAMME OF THE DOCTORAL STUDY IS BASED

ORDINAL NUMBER: 1.

TITLE OF THE PROJECT: Novel Bone Regeneration Drug Osteogrow: Therapeutic Solution for Lumbar Back Pain (OSTEOproSPINE)

PROJECT CODE: 779340; H2020-SC1-201-2017/H2020-SC1-Single-Stage-RTD

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/01/2018 - 31/12/2022

SOURCE OF FUNDING: H2020

ORDINAL NUMBER: 2.

TITLE OF THE PROJECT: Molekularna, epidemiološka i klinička obilježja zaraze HIV-om u Hrvatskoj (MEKHH/MECHC) / Molecular, epidemiological and clinical features of HIV infection in Croatia

PROJECT CODE: IP-4461

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/10/2015 – 30/09/2019/

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 3.

TITLE OF THE PROJECT: Genotip-fenotip korelacija u Alportovom sindromu i nefropatiji tankih glomerularnih bazalnim membrane (GpofASandTBMN) / Genotype-phenotype correlation in Alport's syndrome and nephropathy of thin glomerular basal membranes

PROJECT CODE: IP-2151

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/09/2015 – 31/08/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 4.

TITLE OF THE PROJECT: Kronične upalne bolesti crijeva u djece: incidencija, tijek bolesti te uloga prehrane i crijevne mikroflore u etiopatogenezi / Chronic inflammatory bowel disease in children: incidence, course of disease and the role of diet and intestinal microflora in etiopathogenesis

PROJECT CODE: IP-3788

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/03/2016 – 28/02/2020

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 5.

TITLE OF THE PROJECT: Subplate zona ljudskog mozga: neriješeni problem (HUMANSUBPLATE) / Subplate zone of the human brain: the unresolved problem

PROJECT CODE: IP-4517

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/01/2016 – 31/12/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 6.

TITLE OF THE PROJECT: Molekularni posrednici koštane resorpcije uvjetovane receptorom Fas u artritisu (MEFRA) / Molecular bone resorption mediators mediated by Fas receptor in arthritis

PROJECT CODE: IP-7406

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 02/11/2015 – 31/10/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 7.

TITLE OF THE PROJECT: Istraživanje unosa joda u trudnoći i djetinjstvu u svjetlu nacionalne strategije prevencije poremećaja uzrokovanih nedostatkom joda (IPACSTOPIDD) / Study of iodine intake in pregnancy and childhood in light of the national strategy for the prevention of iodine deficiency disorders

PROJECT CODE: IP-6499

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 22/09/2015 – 21/09/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 8.

TITLE OF THE PROJECT: Ispitivanje reaktivnosti trombocita u različitim srčanožilnim bolestima (SPARELIFE-CVD) / Investigation of platelet reactivity in various cardiovascular diseases

PROJECT CODE: IP-8403

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/12/2015 – 30/11/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 9.

TITLE OF THE PROJECT: Reprogramiranje citoprotektivnih puteva u mezoteliomu (ReprogrammingMM) / Reprogramming cytoprotective pathways in mesothelioma

PROJECT CODE: IP-4173

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/12/2015 – 30/11/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 10.

TITLE OF THE PROJECT: Hiperfosforilacija, agregacija i transsinaptički prijenos tau proteina u Alzheimerovoj bolesti: analiza likvora i ispitivanje potencijalnih neuroprotektivnih spojeva (ALZTAUPROTECT) / Hyperphosphorylation, aggregation and trans-sinaptic transmission of Alzheimer's disease: liquid analysis and potential neuroprotective tests

PROJECT CODE: IP-9730

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 12/10/2015 – 11/10/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 11.

TITLE OF THE PROJECT: Novootkrivene cirkulirajuće izoforme BMP1 proteina kao biomarkeri i terapijski ciljevi za humane bolesti (BMP1-IsoFor) / Newly discovered circulating isoforms of BMP1 proteins as biomarkers and therapeutic goals for human diseases

PROJECT CODE: IP-3509

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/01/2016 – 31/12/2018

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 12.

TITLE OF THE PROJECT: Adipocitokinima modulirana disfunkcija endotela u podlozi mikrovaskularnih komplikacija šećerne bolesti tipa 1 i tipa 2 (ADIEDM) / Adipocytokine modulated endothelial dysfunction underlying microvascular complications of type 1 and type 2 diabetes mellitus

PROJECT CODE: IP-7459

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 16/12/2015 – 15/12/2019

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 13.

TITLE OF THE PROJECT: Vrijednosti i odluke na kraju života (VAL-DE-END) / Values and decisions at the end of life

PROJECT CODE: IP-2721

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/09/2017 – 31/08/2020

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 14.

TITLE OF THE PROJECT: Sonoelastografija i magnetska rezonancija u dijagnostici i liječenju karcinoma dojke (EL-MRI-BREAST) / Sonoelastography and magnetic resonance imaging in diagnosis and treatment of breast cancer

PROJECT CODE: IP-2997

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 20/03/2017 – 19/03/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 15.

TITLE OF THE PROJECT: Multimodalni prikaz molekularnih zbivanja tijekom oporavka mišjeg mozga nakon ishemijskog oštećenja (RepairStroke) / Multimodal representation of molecular events during recovery of mouse brain after ischemic damage

PROJECT CODE: IP-1892

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/12/2017 – 30/11/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 16.

TITLE OF THE PROJECT: Epigenetički biomarkeri u krvi i ejakulatu bolesnika sa seminomom testisa (epiSem) / Epigenetic biomarkers in the blood and ejaculate of the testicular semen

PROJECT CODE: IP-3692

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/08/2017 – 31/07/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 17.

TITLE OF THE PROJECT: Evolucija upalnog artritisa u djece: uloga osnaženoga muskuloskeletnoga ultrazvukate epigenetskih, proteinskih i disbiotičkih biomarkera u razvoju juvenilnog idiopatskog artritisa (childARTHRITISevolve) / Evolution of inflammatory arthritis in children: the role of enhanced musculoskeletal ultrasound of epigenetic, protein and dysbiotic biomarkers in the development of juvenile idiopathic arthritis

PROJECT CODE: IP-4771

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/04/2017 – 31/03/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 18.

TITLE OF THE PROJECT: Epidemiologija hipertenzije i unos kuhinjske soli u Hrvatskoj (EH-UH 2) / Epidemiology of hypertension and salt intake in Croatia

PROJECT CODE: IP-9033

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/09/2017 – 31/08/2020

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 19.

TITLE OF THE PROJECT: Molekularni biljezi vulnerabilnosti, adaptacije i plastičnosti neurona u akutnoj i kroničnoj ozljedi mozga (NeuroReact) / Molecular signs of neuron vulnerability, adaptation and plasticity in acute and chronic brain injury

PROJECT CODE: IP-8636

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/06/2017 – 31/05/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 20.

TITLE OF THE PROJECT: Matične stanice usne šupljine čovjeka za liječenje ishemijske bolesti mozga (ORASTEM) / Stem cells of the human oral cavity for the treatment of cerebral ischemia

PROJECT CODE: IP-9451

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/10/2017 – 30/09/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 21.

TITLE OF THE PROJECT: Novi biomarkeri kronične bolesti presatka protiv primatelja (Bio-cGVHD) / Novel biomarkers of chronic Graft-versus-Host disease

PROJECT CODE: IP-8046

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 20/03/2017 – 19/03/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 22.

TITLE OF THE PROJECT: Signalni mehanizmi i metaboličke promjene u diferencijaciji stanica akutne mijeloične leukemije (SignalmetabAML) / Signal mechanisms and metabolic changes in the differentiation of acute myelogenous leukemia cells

PROJECT CODE: IP-4581

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 15/04/2017 – 14/04/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 23.

TITLE OF THE PROJECT: Razvoj novih antitijela (biološki lijek) koja selektivno inhibiraju izražaj hepcidina u jetri za terapiju anemije kronične bolesti (BMP6Fe3) / Development of new antibodies (biological drug) that selectively inhibit the expression of hepcidin in the liver for chronic disease anemia

PROJECT CODE: IP-2169

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/07/2017 – 30/06/2021

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 24.

TITLE OF THE PROJECT: Uloga bradikinina u ishemiji mozga i mrežnice u mišjim modelima dijabetesa (BRADISCHEMIA) / The role of bradykinin in ischemia of the brain and retina in mouse models of diabetes

PROJECT CODE: UIP-8082

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/09/2018 – 31/08/2023

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 25.

TITLE OF THE PROJECT: Epigenetički biomarkeri raka prostate (epiPro) / Epigenetic biomarkers of prostate cancer

PROJECT CODE: UIP-8138

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/04/2018 – 31/03/2023

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 26.

TITLE OF THE PROJECT: Uloga Notch signalnog puta u patogenezi jetrene fibroze (NOFIBRO) / The role of the Notch signaling pathway in pathogenesis of liver fibrosis

PROJECT CODE: UIP-1965

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 16/07/2018 – 15/07/2023

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 27.

TITLE OF THE PROJECT: Misterij subtalamusa - anatomska podjela subtalamičke jezgre (3STAN) / Mystery of the subthalamus - anatomical division of the subthalamic nucleus

PROJECT CODE: UIP-7578

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 01/06/2018 – 31/05/2023

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 28.

TITLE OF THE PROJECT: Opasnosti i prednosti društvenih mreža - e-profesionalizam zdravstvenih djelatnika (SMePROF) / Dangers and benefits of social networks - e-professionalism of health professionals

PROJECT CODE: UIP-2140

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 09/05/2018 – 08/05/2023

SOURCE OF FUNDING: Hrvatska zaklada za znanost / Croatian Science Foundation

ORDINAL NUMBER: 29.

TITLE OF THE PROJECT: Znanstveni centar izvrsnosti za reproduktivnu i regenerativnu medicinu (CERRM) / Centre of Research Excellence for Reproductive and Regenerative Medicine

PROJECT CODE:

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 2014 - 2019

SOURCE OF FUNDING: Ministarstvo znanosti i obrazovanja iz Europskih strukturnih i investicijskih fondova / Ministry of Science and Education from European Structural and Investment Funds

ORDINAL NUMBER: 30.

TITLE OF THE PROJECT: Znanstveni centar izvrsnosti za temeljnu, kliničku i translacijsku neuroznanost (ZCI – Neuro) / Centre of Research Excellence for Basic, Clinical and Translational Neuroscience

PROJECT CODE:

DURATION OF THE PROJECT (START AND END DATE OF THE PROJECT): 2015 - 2020

SOURCE OF FUNDING: Ministarstvo znanosti i obrazovanja iz Europskih strukturnih i investicijskih fondova / Ministry of Science and Education from European Structural and Investment Funds