

UNIVERSITY OF ZAGREB
SCHOOL OF DENTAL MEDICINE



STRATEGIC PROGRAM
OF SCIENTIFIC RESEARCH FOR THE PERIOD
2015 - 2019

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1. PURPOSE OF THE ESTABLISHMENT AND OPERATION OF THE SCIENTIFIC ORGANIZATION

The School of Dental Medicine, University of Zagreb, being the only autonomous higher education institution in the Republic of Croatia, is profiled as a scientific and educational institution. In addition to the fundamental purpose of training of the doctors of dentistry / doctors of dental medicine, the same kind of attention is paid to scientific research that is based on a special inter-institutional and international cooperation.

The backbone of the scientific research stands within the doctoral program in Dental Medicine.

The history of the School of Dental Medicine at the University of Zagreb includes the following three stages of development:

- An initial period of higher dental teaching institution from 1922 to 1948;
- Establishing and operation of the Odontology Department at the School of Medicine, University of Zagreb from 1948 to 1962;
- Founding and rise of the School of Dental Medicine since 1962, during over five decades, to the present day.

The base of the contemporary society rests ever increasingly on knowledge, which fact is also recognized by the School of Dental Medicine, University of Zagreb. It has, thereby, in the past ten years, by its structure, its organization of teaching and curricula, become the holder of this profession and this science in the Republic of Croatia.

2. ANALYSIS OF SCIENTIFIC POTENTIALS OF THE SCIENTIFIC ORGANIZATION AND ITS POSITION IN SCIENTIFIC AND BUSINESS ENVIRONMENT

2.1. Teaching staff and associates

The Faculty employee category within the School of Dental Medicine Personnel System is limited to persons who hold one of the ranks in an academic department or its equivalent in a University of Zagreb. The Faculty members hold scientific-educational, scientific or educational titles as follows:

- 44 full professors
- 40 associate professors
- 28 assistant professors
- 11 research assistants (teaching assistants)
- 10 senior research assistants
- 2 senior lecturers
- 22 junior researchers (research novices)

We are satisfied with academic ranks of our faculty both lecturers and and associates but there still remains the decision over promoting those with associate titles of senior assistants to the rank of teaching assistant professors considering the fact that new appointments are rare regardless of the fact that junior researchers have obtained the outstanding scientific results. Nevertheless, we shall continue to foster the development of outstanding scientists and enable them to expand their potential to make significant contributions to the teaching process and to their field of research.

The School of Dental Medicine University of Zagreb is the central national research center in the field of dental medicine. Year after year, it has been rising the scientific level and improving the quality of research, thus aspiring to reach the European and world standards of research excellence in order to become a respectable factor not only in the national and regional but also in a European research network.

2.2 Scientific research productivity

Researchers of the School of Dental Medicine, University of Zagreb in cooperation with other scientists from Croatia and abroad are involved in studies of stem cells of oral mucosa and dental pulp, salivary diagnostics, pulp biology and regeneration, dental materials, proteomics and metal proteomics, application of lasers, orofacial pain, dental trauma, mineralized tissue, morphological and biomechanical aspects of orthodontics, anatomy, physiology and anthropology of the stomatognathic system, as well as in studies of forensic and paleoanthropological research. The Research mission of the University is to facilitate and promote the pursuit, discovery and dissemination of knowledge through research, creative scholarship and technology transfer that impact our students and a large number of our constituents within the University of Zagreb, the nation and the world.

The researchers of the School of Dental Medicine, University of Zagreb carry out their main scientific activities through:

- Leadership and partnership in research projects financed by the Croatian and European institutions
- Mentoring PhD students and other students interested in scientific work
- Organizing and participating in scientific conferences in Croatia and abroad
- Publishing scientific papers
- Publishing books and textbooks
- Publishing an international bilingual scientific journal

In the previous five year period, the researchers from the School of Dental Medicine, University of Zagreb led 44 research projects which were financed by the Ministry of Science, Education and Sports, Croatian Science Foundation and the University of Zagreb. Since multidisciplinary research is a form of cooperative research that involves re-

searchers working across disciplines, either within an institution or in different institutions, some of the researchers from the School were running research cooperation and were working on international projects such as FP6, FP7, and IPA.

Over the past five years, the researchers from the School of Dental Medicine, University of Zagreb were mentors to 85 doctoral students who completed their doctoral studies at the postgraduate study of Dental Medicine. In cooperation with doctoral students, they published 149 scientific papers in international journals relevant to their appointment into scientific academic titles. Furthermore, in the same period, they organized 18 international conferences. They participated in more than 70 different scientific conferences in Croatia and abroad in the role of invited speakers and / or active participants for which they had submitted more than 200 conference abstracts.

The scientific activities of the researchers from the School of Dental Medicine, University of Zagreb in the five-year period have resulted in publications in high profile journals. 638 scientific and review papers were published in journals included in the database WOS (CC and SCIE), 21 books and textbooks, and 44 book chapters. The analysis of scientific productivity is shown in Table 2.1.

For as much as 49 years, the employees of the School of Dental Medicine, University of Zagreb have been publishing the international bilingual *Acta Stomatologica Croatica* journal which is indexed in a wide range of electronic databases such as Scopus, Chemical Abstracts, Index Copernicus, Directory of Open Access Journals and EBSCO.

Here are some of the best scientific journals in which researchers from the School of Dental Medicine in Zagreb publish their scientific papers and which are, according to JCR-, in Q1 category of high impact factor:

JAMA-Journal of The American Medical Association (with the five-year impact factor: 29.914)

Circulation (with the five-year impact factor: 15.326)

Arthritis and rheumatism (with the five-year impact factor: 7.987)

Stroke(with the five-year impact factor: 6.757)

Faseb Journal (with the five-year impact factor: 6.045)

International Journal of Cardiology (with the five-year impact factor : 5.101)

Bone (with the five-year impact factor : 4.587)

Dental Materials (with the five-year impact factor : 4.463)

Journal of Clinical Periodontology (with the five-year impact factor : 4.506)

Osteoporosis International (with the five-year impact factor : 4.446)

The selection of journals which the teachers of Dental Medicine investigate, and in which they publish their scientific papers, is based on relevance and their impact factor in a particular scientific field. The selection of journals reflects the diversity of the areas in which teachers explore. Some of the selected journals are published by the world renowned publishers, and they can be found in the following areas: *Dentistry, Oral Surgery & Medicine, Medicine General & Internal, Cardial & Cardiovascular systems, Rheumatology, Biochemistry & Molecular Biology, Clinical Neurology, Endocrinology & Metabolism, Multidisciplinary Sciences* etc.

If we focus solely on the core - the dental medicine as a profession, category Dentistry, Oral Surgery Medicine, we would add the following scientific journals:

- *Clinical Oral Implants Research* (with the five-year impact factor: 4.206)

- *Oral Oncology* (with the five-year impact factor: 3.410)

- *Journal of Endodontics* (with the five-year impact factor: 3.122)

- *Journal of Periodontology* (with the five-year impact factor :3.083)

- *Journal of Dentistry* (with the five-year impact factor: 2.916)

The range and quality of scientific research at the School of Dental Medicine is systematically monitored. Scientific productivity projects are analyzed according to the reference databases (Wos and Crosby) with regard to the number and type of publications (scientific, review, textbook and chapter in the textbook). The quality of published papers is evaluated based on the impact factor and Q factor of the journal in which the paper is published. Also, the quality of peer-reviewed scientific research articles is evaluated based on citations of the published paper. Additionally, the number of peer-reviewed scientific research articles published in *Acta Stomatologica Croatica* journal is also taken into account..

Table 2.1 Analysis of Research Productivity

	Publications in the journals included in the WoS(CC and SCIE) databases	Authorship of books	Editorship of books	Chapters in peer-reviewed books	Textbooks and written materials
2010	128	1	2	12	3
2011	152	0	0	12	6
2012	179	3	0	14	2
2013	102	1	1	5	2
2014	77	0	0	1	0

2.3. Scientific and research projects

The School of Dental Medicine is in scientific research connected with a large number of constituents of the University of Zagreb and other Croatian universities, institutes of the country as well as with universities and scientific institutions in the world. It includes basic research, developmental research and applied research.

Over the past five years, scientific research has been organized within the framework of 29 scientific research projects. The research was funded by the Ministry of Science, Education and Sports (MZOS). Also, a short-term support has been provided by the University of Zagreb. A cooperative research program with funding support from the Croatian Science Foundation was carried out from 2012 to 2015: 'Evaluation of new bioactive materials and procedures in restorative dentistry'. It was led by professor Zrinka Tarle, PhD. Apart from the School of Dental Medicine as the holder of the program, the Institute of Physics and 'Ruder Bošković' Institute participated in the program.

From 2013, the IADR Regional Development project 'Bulk versus incremental layering of a bulk-fill composite: a practice-based, randomized, controlled, prospective clinical study' has been in progress. The project has been led by Professor Zrinka Tarle and her associates who come from Croatia, Hungary, Serbia, Germany and Belgium.

In the following period, starting in 2015, four new projects have been approved and the Croatian Science Foundation accepted to finance them:

1.

Name of the project: Role of oxidative stress and opiorphin in temporomandibular disorders

Project leader: associate professor Iva Alajbeg, PhD

Duration of the project: four years

Participating institutions: The University Hospital Centre in Zagreb, Croatia.

Abstract: The project aims to quantify markers of oxidative stress, total antioxidant capacity and endogenous peptide opiorphin in the saliva of patients with TMD and compare them with a control group. Since chronic exposure to stress can cause hyperalgesia as a result of the stress response in the hypothalamic-pituitary-adrenal axis, the objective is to investigate the mechanism by comparing opiorphin and markers of oxidative stress to the level of salivary cortisol. Finding elevated biomarkers of oxidative stress, apart from its importance as part of the puzzle mechanism of TMD, could contribute to the diagnosis of TMD. If this proves true, then the oxidative stress itself could be a therapeutic target. Salivary opiorphin could, due to its proven analgesic effect, further serve as a potential medication for orofacial pain syndromes.

2.

Name of the project: The isolation, quantification and kinetics of salivary Ap4A, SCCA and TROP2 in patients with oral cancer and potentially malignant oral disorders

Project leader: full-professor Darko Macan, PhD

Duration of the project: 4 years

Participating institutions : Clinical Hospital Dubrava, "Ruder Bošković" Institute

Abstract: the aim of the project is to isolate, quantify, explain the role and describe the kinetics of diadenosine triphosphate (Ap4A), 'squamous cell carcinoma associated antigen' (SCCA), 'Trophoblast cell surface antigen' (TROP2) in healthy subjects and in patients with potentially malignant oral disorders (PMOD) and oral carcinoma (OC-om).

The abovementioned markers will be dynamically measured, before and after surgery, after radiotherapy, one and two years after the initial diagnosis and their circadian rhythm will be determined.

The Liquid Chromatography- Ion Trap- Mass Spectrometry, Multiple Reaction Monitoring method (LC-IT-MS MRM) will be developed for the isolation and quantification of markers.

To our knowledge, this method has not been used for the isolation and quantification of these markers. So far, Ap4A and TROP2 have not been isolated from saliva.

The results of this study may enable the creation of tumor-specific test for OC, thereby providing an earlier diagnosis of OC preferably before the clinical symptoms. They could raise the five-year survival rate and enable an earlier diagnosis of recurrence and / or new primary tumors. Also, the results could help patients increase their quality of life after treatment.

3.

Name of the project : The role of estrogen and androgen receptors in the activation of the stroma of oral squamous cell carcinoma and the effect on survival of patients

Project leader: associate professor Vanja Vučićević Boras, PhD

Duration of the project: 4 years

Participating institutions: Institute for Medical Research and Occupational Health, Zagreb, Clinical Hospital Dubrava, University Hospital for Tumors and Allied Diseases, University Clinical Hospital Center "Sestre Milosrdnice", Antun Major, The University Hospital Centre in Zagreb, The Norwegian Institute for Air Research (NILU), Oslo, Norway.

Abstract: Oral cancer is clearly associated with drinking alcohol and smoking. It is already known fact that a large number of cancers in the body are result of *inter alia* smoking and drinking alcohol which have effects at the level of estrogen and androgen receptors in the stroma of the cancer itself. During the proliferation of cancer cells, there is an increased expression of several factors such as vascular endothelial factors, hypoxia factors, matrix metalloproteinases and others. In regard to these factors, the idea of this project is to establish a mutual link between hormones and factors that affect the growth of cancer cells. Besides, the aim of the project is to correlate the obtained findings with the presence of metastases and the length of survival of patients.

4.

Name of the project: Defining possibilities of using Mini dental implants (MDI); their outcomes *in vitro* and in clinical randomised prospective studies.

Project leader: professor Asja Čelebić, PhD

Duration of the project: 4 years

Participating institutions: Mechanical Engineering Faculty in Slavonski Brod, The Faculty of Graphic Arts of the University of Zagreb.

Abstract: The aim of the research is to obtain new information about the indications and to explore additional potentials in order to improve the therapy by use of mini dental implants (MDI) in prosthodontics. After testing performed on models, patients will be inserted 1, 2, or 3 mini implants

(MDI) rather than using a standard protocol: 4 MDI will be placed in the mandible for overdenture. Before that, tests will be performed on the models. Clinical research will be based on longitudinal studies. The main objective of the research is to gain a better insight into the clinical results achieved by MDI therapy as well as to gain insight into the reaction of the surrounding soft and hard tissues and distant hard tissue with the goal to make the therapy by mini dental implants more accessible to a wider range of patients.

The University of Zagreb grants for the academic year 2015-2016

Ivan Alajbeg	Neuroectodermal differentiation potential of mesenchymal stem cells isolated from the oral cavity
Ivica Anić	The effect of laser-induced flushing on dentin biofilm and on the bonding strength of composite materials
Tomislav Badel	Orofacial pain and osteoarthritis of the temporomandibular joint - years of follow-up
Asja Čelebić	The study of various aspects of prosthetic and implant-prosthetic procedures and materials and the treatment of temporomandibular disorders
Jelena Dumančić	The project for the promotion of oral health of the blind and visually impaired
Domagoj Glavina	Etiology, treatment and prevention of dental injuries in children and adolescents
Andreja Jelinić Carek	Esthetic analysis of hard and soft tissues of the anterior teeth of adolescents in the Republic of Croatia
Dalibor Karlović	The impact of monoamine and glutamate system on cognitive functioning and psychoticism
Dubravka Knezović Zlatarić	Assessment of changes in color and whitening index of vital and non-vital natural teeth using different methods of bleaching and microabrasion
Sonja Kraljević Šimunković	Diagnostics and treatment of craniomandibular disorders
Martina Majstorović	Qualitative evaluation of the products for the maintenance of oral hygiene and recommendations for their application
Ketij Mehulić	The study of chemical stability and functional durability of new ceramic materials in dental medicine
Ivana Miletić	Physical and mechanical properties of bioactive and fiber reinforced materials
Kata Rošin-Grget	The effect of smoking on the subgingival microbial content and on mineral composition of saliva in young smokers
Višnja Škerk	Genomic analysis of the transcriptome found in the sediment of urine of female patients with urinary tract infections caused by Escherichia coli uropathogen
Marin Vodanović	The stomatognathic system as the starting point of forensic and archaeological research

2.4. International Cooperation

International cooperation, international activities and internationalization of the School of Dental Medicine, University of Zagreb have been significantly increasing. In the last three years, seven Erasmus agreements (Denmark, Germany, Portugal, Poland, Slovakia, Hungary, Turkey), as well as three cooperation agreements (University of Varna, Bulgaria; University of Sao Paulo, Brazil and University of Tufts - Boston, USA) have been signed.

Students

In 2014/2015 academic year, 6 foreign Erasmus students spent a semester at the School of Dental Medicine, University of Zagreb, and a larger number of foreign students are expected to come to the School next academic year. Last year, five students spent a semester at universities abroad, and the Erasmus Scholarships, funded by the European Union, will be awarded to two students coming from the School next academic year. Students' interest in the Erasmus internship has increased and 6 students who had been awarded such internships had already spent a semester at universities abroad (Austria, Germany, Norway, UK). It is the first time that foreign students who have been eligible for an Erasmus mobility scholarship, that is for an internship, will come to the School next academic year (one student from Slovakia has already confirmed the stay and yet another student from Italy has shown some interest).

Over the last five years, three foreign students within the Basileus scholarships (Niš, Sarajevo, Skopje) stayed at the School of Dental Medicine in Zagreb, and three students from the School of Dental Medicine, University of Zagreb stayed abroad (two students stayed in Heidelberg and one in Belgrade).

Student organizations are extremely active. Students work in two organizations: a student organization named Student Association of Dental Medicine (USDAM, as part of European Dental Students Association) and another organization which is a constituent of the University of Zagreb Student Union (in Croatian: Studentski zbor).

Student Association of Dental Medicine has two world-famous projects: The Virtual World Congress of Dental Students, which is an innovative project by a national dental students' association in Croatia (since 2012 and by 2015 it will have been organized for the fourth time) and EDSA Summer Camp- a new summer camp which has been developed as part of the EDSA program, (from 2011 and by 2015 it will have been organized for the fifth time). Both events attract students and lecturers from all over the world and they have become a global brand among student associations.

Student Association is a coordinator for the program EDSA Research that provides financial assistance to students who stay for several weeks at foreign universities in order to be introduced into the scientific work (Royal University - King's College London, University of Yeditepe - Yeditepe Universitesi Istanbul and ACTA in Amsterdam).

Teaching staff

As part of the multilateral Erasmus program, in which our school is participating, a number of teachers from Ankara, Greifswald, London and Viseu visited our School. Of these, the last three held teaching ('Erasmus Teaching Assignment'), which was a great benefit to both, our students and the entire academic community. Academic staff- four teachers from the School of Dental Medicine, University of Zagreb realised their Erasmus mobility and stayed at universities in Greifswald, Poznan, Stockholm (the last one as 'Teaching Assignment', others as 'Job Shadowing'). Erasmus mobility has been approved for another four teachers from our School. Next academic year, they will stay at ACTA Amsterdam, Skopje, Nice and London.

Since 2008, associate professor Martina Majstorović, PhD has been at New York University within Fulbright Scholarship where she remained through her promotion to adjunct associate professor. She stills goes there periodically and cooperates with the institution.

Teacher mobility results in applications of EU projects (Erasmus KA2 Strategic Partnership and the Horizon 2020), of which 3 are currently in the evaluation process (main filing institutions are University of Turin, University of Milan and the University of Sifa, Turkey). The School of Dental Medicine is a cooperative institution taking part in COST TD1104 Action project "EP4Bio2Med - European network for development of electroporation-based technologies and treatments".

In 2016, the School of Dental Medicine, University of Zagreb begins the study program in the English language, which suggests a quantum leap beyond previous internationalization.

2.5. Organizing scientific conferences

The results of scientific research obtained by the employees of the School of Dental Medicine contribute to the establishment of cooperative research relationships with many international research institutions, universities and researchers. The results of such research often give impetus to broader cooperation as well as to hosting professors / lecturers at the School and the Faculty staff in international institutions and, also, to the maintenance of invited lectures at scientific congresses. In addition to this, our scholars conduct research, teach, and work in a variety of capacities throughout the institutions all over the world. Our scholar population includes everyone from short-term visitors who either conduct research on unpaid appointments to permanent tenure-track professors. Our visiting scholars are often invited to actively participate in international conferences and other University activities, such as delivering a formal lecture to the school/college, participating in departmental or interdisciplinary program seminars, engaging in formal or informal discussions with graduate students, and undertaking cooperative research with faculty or staff. A large number of important international scientific conferences were organized by the employees from the School and they are testament to

their scientific value and recognition in the world. Here are only the most important conferences, congresses and symposia held in the previous period:

- International Association for Dental Research (Međunarodno društvo za istraživanje u dentalnoj medicini) – Congress of the Pan European Region (IADR/PER), Dubrovnik, September 9-13, 2014.
- 16th International Symposium on Dental Morphology and 1st Congress of the International Association for Paedodontology, Zagreb, August 26 – 30, 2014.
- 5th Croatian Congress of Dermatovenerologists with International participation, Zagreb, May 8 – 11, 2014.
- 5th International Congress of the Croatian Society for Dental Implantology of the Croatian Medical Association, Varaždin, November 7- 9, 2013.
- 5th International Congress of the Croatian Dental Society of the Croatian Medical Association, Zagreb, December 5 - 7, 2013.
- 1st Regional Congress on Education and Research in Oncology, Zagreb, November 20 - 23, 2013.
- 5th Croatian Congress on Urogenital and Sexually Transmitted Infections with international participation, Opatija, April 27- 28, 2013.
- 21th Congress of the European Association for Cranio-Maxillo-Facial Surgery- (EACMFS), Dubrovnik, September 11 – 15, 2012.
- 2nd Scientific Gathering on Orofacial Diseases – Current Restorative and Regenerative Techniques Used in Dental Medicine, the Croatian Academy of Sciences and Arts – Department of Medical Sciences, Zagreb, October 26, 2012
- International School of Headache and Related Disorders in Collaboration with European Association of Headache, Zagreb, October 4 – 6, 2012.
- International Congress of the Croatian Society for Dental Implantology of the Croatian Medical Association, Opatija, October 6 – 8, 2011.

Scientific and professional performances of the employees have been recognized by the public, which is reflected in the performances in various public media for the promotion of scientific approach to maintaining oral health.

The prestigious Ambassador of Croatian Congress Tourism Award in the category of individuals / institutions is important to people from scientific, cultural, sports and economic community because it recognizes them for their work and acknowledges their contributions. In 2014, professor Zrika Tarle, PhD, President of the Congress, won this Award for her outstanding contribution to organization of the *International Association for Dental Research Pan-European Region Meeting* (IADR/PER) which was held in Dubrovnik, September 9 -13, 2014 with more than 1,000 participants - distinguished scientists from 60 countries worldwide sharing their experiences and knowledge.

2.6. Publishing Activities

Acta stomatologica Croatica, interdisciplinary journal

Acta stomatologica Croatica (Online): ISSN 1846-0410
www.ascro.hr

Acta stomatologica Croatica (Print): ISSN 0001-7019

DOI: 10.15644/asc

Acta Stomatologica Croatica (hereinafter referred to as ASCRO) is an interdisciplinary journal in the medical field of Oral and Dental Science, with a 48 years long tradition.

Namely, back in 1966, at the proposal of several of our teachers meritorious for the development of the profession - the School of Dental Medicine, University of Zagreb, and leading persons at the Croatian Dental Society and several specialist societies within the framework of the Croatian Medical Association, initiated this journal in order to scientifically contribute to the development of the profession, educate fellow doctors of dental medicine, and enable scientists and teachers to attain the conditions for scientific and educational progress by publishing the results of their studies in the ASCRO.

It was then that Zdenko Njemirovskij, PhD, a professor of dental pathology, was elected the Editor in Chief, and who, by his knowledge, will and skill, made it possible for ASCRO to be indexed in the international scientific databases (index of dental literature - Index Medicus, a Medline precursor).

ASCRO was continuously published four times a year, and was a very popular journal among colleagues in the entire former state. Unfortunately, the death of professor Njemirovskij, PhD, in 1989 brought on a loss of the high status ASCRO once had. After that, until 1996, professor Vladimir Lapter, PhD, took over the post of Editor in Chief. During the breakup of former Yugoslavia, and the aggression on Croatia, publishing of ASCRO lost the continuity which it once had, thus the authors and reviewers became unmotivated, and by 1996, ASCRO kept losing popularity. From 1996 to 2006, the Editor in Chief was professor Goran Knežević, PhD, during which time the magazine was given a new, more modern expression - ASCRO was transformed, an international editorial board was introduced, and all articles started being published in a bilingual form.

Due to the loss of continuity, the ASCRO staff were forced to invest serious efforts as they sought to regain the lost international indexing and popularity among peers.

In late 2005, the editor in chief at the time, professor Goran Knežević, PhD, retired from the position.

Since the beginning of 2006 (Volume 40), professor Hrvoje Brkic, PhD has been the Editor in Chief. Innovations are being introduced whereby it is primarily sought to restore the regularity of publishing, with the intention to open ASCRO to the world once again. As far as the innovations are concerned, let us point out the electronic form of the jour-

nal Acta Stomatologica Croatica (Online): ISSN 1846-0410 whose Open Access makes it accessible all over the world, at any time, and from anywhere; the dual international review (peer review); expanding the international editorial board; introducing a biomedical statistician in order to control the display of results and scientometric analysis of the published articles. Quality control is carried out on each cited reference, while special care is dedicated to the Croatian and English linguistic correctness, as well as to the maximum development of Croatian dental terminology. Thanks to all these facts, ASCRO is becoming very popular in the world, and more articles by foreign authors are published in comparison with national authors. Each paper is selected by the Editor in Chief, and then it is reviewed twice on the international level. The teaching staff of the School of Dental Medicine, University of Zagreb takes part in reviewing, albeit they do so solely in the cases of foreign papers. Articles are received through the electronic program Open Journal System, which enables faster and more efficient work for the editors, authors, reviewers and editorial board.

In the last five years ASCRO has scored indexing in seven international index bases: Chemical Abstracts, Index Copernicus, Directory of Open Access Journals, EBSCO, Empase, CrossRef, and in Scopus, the world's largest index and citation database.

Today, through a regular electronic monitoring of ASCRO, we can see exactly who reads what, and where they read it. According to these data, the volumes are organized so that the key articles affect the number of readers, and incite interest in each issue. In the past year, every day 250 to 300 readers follow us at www.ascro.hr, which makes for more than 7,500 visits a month. After the Croatian scientific portal – HRČAK, containing over two hundred scientific and professional journals, ASCRO is in second place, according to the number of readers, and is the only biomedical journal among the top ten. Since 2014, ASCRO also received a DOI label: 10.15644/asc, and for the first time every article in the volume 48 was labeled as such.

2.7. Doctoral studies

Postgraduate university doctoral degree in Dental Medicine

Postgraduate university doctoral degree in dental medicine has a duration of three years and upon its completion a total of 180 credits is appointed - 60 per year. Admission requirements for the next academic year are determined by the study program and curriculum.

The purpose of doctoral studies of Dental Medicine is to bring out a quality PhDs, with a distinctive doctorate, basis for which is found in agglomeration of knowledge and interdisciplinary association, as well as in scientific excellence in the doctoral research, and in the aptitude to cooperate with other doctoral studies. For generations now, the Postgraduate studies in the field of dental medicine have been al-

lowing the acquisition of theoretical and practical knowledge and skills, imparting critical scientific thinking skills and enabling candidates to express informed judgments, as well as to cooperate with scientists from the selected field of dental science around the world. This undoubtedly supports the claim to competitiveness of the acquired scientific knowledge, and the comparability and competence of our experts on the global markets of knowledge.

The innovativeness of the doctoral program provides interdisciplinary approach, cooperation and partnership, and constitutes its backbone and its very structure. Interdisciplinarity presupposes cooperation with other organizations and institutions of the University in order to provide a holistic approach to research in the field of dental medicine, which is part of the natural science, as well as of the biomedical, social and legal (ethics and deontology), and economic sciences. Doubtless, cooperation is the imperative of our time, because only through joint capacity of institutions and joint effort of teachers of Croatian and European universities and leaders of high-quality scientific projects, can significant results in science be achieved. We hereby simultaneously encourage the mobility of teachers and students, and create conditions for joint programs.

The doctoral program also provides a continuation of training within research projects in the field of biomedicine and health, as well as research sojourns at universities and institutes abroad, as a natural sequence in the scientific maturation of dentists.

In the past five years, 85 doctorates have been successfully completed.

2.8. SWOT analysis

Strengths

- tradition and reputation of the only national and autonomous institution of higher education in the field of dental medicine – the School of Dental Medicine in Zagreb
- a significant number of employees holding scientific-educational and associate titles, some of which are internationally recognized
- a large number of research projects addressing the topics relevant to all branches of dental medicine in the previous period
- branched inter-institutional cooperation in Croatia and abroad
- extensive experience in hosting and organizing scientific conferences at the national, regional, European and global level

48 years of tradition in publishing the scientific Acta Stomatologica Croatica journal

Weaknesses

- researchers' schedules are too busy due to teaching load and other professional tasks which they have to accomplish
- lack of space and equipment at the School of Dental Medicine
- currently insufficient and short-term financial support
- lack of professional administrative support for the application to European projects
- insufficient number of innovations and research done abroad.
- insufficient number of scientific books whose authors are employees of the School.
- lack of the system assessing the quality of national scientific productivity, which would take into account the different aspects of scientific activity of the individual such as scientific papers, conducting research projects, published books, textbooks, scientific monographs, etc., as well as effective mentoring as an integral component of doctoral dissertation process.

Opportunities

- more intensive involvement in national projects
- participation in international research projects
- implementation of a number of inter-institutional and international cooperation with prestigious foreign universities based on joint research projects
- facilitated mobility
- improvement of the system to encourage students and their mentors for the inclusion of students in scientific research
- establishing a system of evaluation of the quality of scientific productivity based on different aspects of scientific activity
- encouraging researchers / teachers on publication of books and textbooks and an adequate evaluation of their scientific/teaching advancement

Threats

- insufficient financial resources at the national level
- issue of criteria and funding priorities
- impossibility of hiring junior researchers
- rigid system of recruitment of new assistant professors
- teaching and professional activities dominate over scientific research and innovation

3. STRATEGIC GOALS

Strategic goal 1: Strengthening the scientific quality (encouraging academic excellence)

Strategic goal 2: Encouraging application and management of national and international projects

Strategic goal 3: Encouraging the international mobility of scientists and

Strategic goal 4: Systematic and organized fostering of interinstitutional and international networking

Strategic goal 5: Institutional care of the staff (introduction of the most successful junior researchers / PhD students to the system of scientific research and education)

Strategic goal 6: Encouraging innovations and their commercialization

4. EXPECTED OUTCOMES OF THE STRATEGIC PROGRAM OF SCIENTIFIC RESEARCH

Activity (1 goal, 2, 4, 5): academic excellence will be reinvigorated and the employees will be encouraged to publish research results in international journals in order to increase the number of scientific papers published in the ISI Web of Science recognized international journals citation databases, that is in journals belonging to the first and second quartile according to their Impact Factor. In this regard, grants will be awarded annually to scientifically most productive, most outstanding PhD students (three awards per year).

Scientific productivity of all employees of the School of Dental Medicine is reported in one month intervals. The Dean presents an oral and written report to the School of Dental Medicine Faculty Council. The meetings of the Council are open to the public.

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected outcomes: increase in the number of published results of scientific research, academic staff motivated for scientific research, due attention will be given to scientifically active employees. Also, the outstanding doctoral candidates will be rewarded.

Activity (1-6): Encourage interdisciplinary and international cooperation in the framework of the project consortium. Continue cooperation with scientists of our university, as well as with scientists from universities abroad in order to improve conditions for the participation of a large number of employees in research projects funded from different sources.

The Board of the School of Dental Medicine added the School to the list of institutions that can apply for EU projects. The application was validated and the School has all the rights to participate in projects H2020 and Erasmus KA2. The decision on the confirmation of LEAR is still in progress in the administration of the European Commission, even though the application and all the documents were submitted in October 2014.

A professional and scientific network has been intensively created at the level of each institute and each specialty through international activities. Besides, the activities on the application of EU projects have been intensified together with international consortia. These activities have a very small percentage of success, but they are important, of course, not only for providing funds for research but also for an additional strengthening of international cooperation.

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected outcomes: Increase in the number of applied research projects, which will result in obtaining funding for scientific research projects. Increase in the number of visiting professors. Increase in the number of our academic staff who will realize their mobility at foreign universities in the framework of different mobility programs.

Activity (goal 1-6) it is necessary to make decisions on stimulating the participation of employees as a member of the organizational and scientific committees or chairs of the scientific sessions at the international scientific and professional conferences. So far, these distinctions do not work, nor is it defined how to stimulate the academic staff to be more active. Researchers and teaching staff could be stimulated to continually improve their competencies and to develop academic excellence by reporting about such activities to the Faculty Council, or as part of special requirements for promotion. Since the financial resources available to finance the School's programs are restricted, the School cannot provide funding for conference participation or cover transportation costs even to excellent scholars.

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected outcomes: increase the presence of our employees in the organizational and scientific committees of international conferences; increase the presence of our employees as chairmen of the scientific sessions at the international meetings.

Activity (goal 1-6) The School of Dental Medicine will actively seek various funding sources, including companies and developing professional expertise, in order to create revenue that could be spent for such purposes. In addition, the Board of the School regularly informs employees about calls for academic mobility of the University and the Erasmus Staff Mobility, and actively stimulates and helps employees to apply and receive funding for conferences and visits to international institutions. The employees of the School of Dental Medicine are encouraged to spend the revenues generated by postgraduate studies or permanent training courses on participation in the meetings.

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected outcomes: increase in the number of participating employees of the School of Dental Medicine in scientific and professional conferences.

Activity (1, 2, 4, 6): Continue to set the conditions for the regular publication of the journal 'Acta Stomatologica'. With the provision of financial resources, we have been constantly working on the inclusion of the journal in new databases. The process for adding the journal to PubMed Central (PMC) is in the final phase. The journal has qualified on one level - the scientific quality of the publication, and the technical quality of its digital files is currently in progress.

The journal is a platform for the presentation of our science. It helps build our international reputation and increases our exposure abroad.

Implementer of activities: Board of the School of Dental Medicine, Editorial Board of ASCRO journal.

Expected outcomes: to ensure ASCRO being regularly published, inclusion of ASCRO in new databases.

Activity (goal 1-6): The annual "International Congress of the School of Dental Medicine University of Zagreb" was introduced in 2015, which is an excellent medium for periodic show of scientific developments and projects being developed at the School, as well as the opportunity to launch original on-going research projects and present their findings to the academic community (horizontally and vertically). As a result, these research projects get the first less formal "review". They give the staff and colleagues chance to 'vent' and offer ideas or opinions beyond formal review, thus ensuring that every research project is based on a strong academic footing. Such an approach will motivate employees within the academic community to present the best possible science in their academic setting, which will be especially motivating for younger teachers who will have an excellent medium for their first presentations at scientific conferences.

In addition, congress has stronger international linkages in rapidly evolving research areas, since it hosts visiting lecturers who are top scientists.

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected activities: motivate employees to present their scientific activities; promote the involvement of young scientists and ensure their presentation; create opportunities for faculty and young researchers to engage and connect with visiting professors from abroad.

Activity (goal 1-6): The Board of the School of Dental Medicine permanently improves conditions in order to keep the doctoral studies running smoothly. PhD studies have continuously been refreshed with new courses, thus making the School of Dental Medicine, University of Zagreb a strong option for PhD studies. These studies are also conducted in English and are designed for candidates interested in academic research, willing to explore multidisciplinary research opportunities given at the School of Dental Medicine. Attempts have been made to promote our School and PhD program abroad in order to motivate foreign candidates to enroll in doctoral studies and attend them. With regard to the recruitment of doctoral students, cooperation has been established with some international agencies ("StudiMed" from Cologne).

Implementer of activities: Board of the School of Dental Medicine, researchers of the School of Dental Medicine.

Expected outcomes: maintaining a high number of domestic participants in doctoral program and increasing the number of international doctoral students (in the English language).

Activity (goal 1-6): International cooperation is an ongoing priority. It is the permanent extension of participating institutions and the signing of new bilateral cooperation agreements with prestigious international institutions, as well as a new Erasmus agreement. Also, the priority of the School of Dental Medicine, when deciding on the allocation of university funds for academic mobility, has always been focused on the financing of the activities which had been previously planned by contracts.

In addition to this, student mobility is encouraged and facilitated by decisions of the Board of the School of Dental Medicine. In fact, despite the fact that student mobility is progressing each year, the numbers are still quite low due to the lack of harmonization between ECTS credits and the content of instruction per year in different universities. Therefore, it is very difficult for students to stay on Erasmus mobility. Consequently, the Board of the School of Dental Medicine decided to help, in real terms, the students upon their return from mobility and recognize the exams which the students have passed abroad.

Management of the School of Dental Medicine supports the international scientific activities of the student organization "EDSA Visiting Research Programme", which includes the stay of our students at a foreign university, or the arrival of foreign students at our School.

Implementer of activities: Board of the School of Dental Medicine, teaching staff and students.

Expected outcomes: increase in the number of mutual mobility of staff and students.

Activity (goal 1-6, with a special stress on 6): The School of Dental Medicine as a unique institution which conducts research and, also, directly and clinically applies biomaterials and pharmaceutical products to the orofacial region, is an ideal partner for scientific cooperation with the business sector. The existing scientific and technical cooperation with the industry (new dental restorative materials based on nanotechnology, impression materials, dental microscopes, non-aromatic naphthalene: a future remedy for oral mucosal lesions to treat the oral mucosa, bone morphogenetic protein, ...) will be expanded and the Board of the School of Dental Medicine will encourage the initiatives of the employees for such cooperation and facilitate it by offering support, as well as legal advice to assist the implementation of such cooperation, in accordance with legal and ethical standards. Sometime in the near future, the School of Dental Medicine plans to establish their own company to serve as a medium for 'spin-off' activities.

Implementer of activity: Board of the School of Dental Medicine, researchers

Expected outcomes: quality science financed by the industry, the publication of scientific results in cooperation with other international teams in multicenter studies, patent applications, education and training efforts for our employees in order to address the design and conduct of rigorous preclinical and clinical studies.

5. SCIENTIFIC RESEARCH ISSUES

The issues of scientific research which are going to be investigated by the researchers from the School in the next period are presented in Table below:

Fields of research	Issues of scientific research	Detailed research program
Biomaterials and technology in dental medicine	Nanomaterials and bioactive materials	<p>The purpose of this study is to discover new formulations of bioactive composite materials based on amorphous calcium phosphate with the improved remineralization and polymerization properties in such a way that a good biocompatibility is maintained. The behavior of nanocomposite materials and bioactive restorative materials with remineralizing effect will be investigated. The aim of this study is to select materials with the best composition for further research. The selection will be based on the results of the degree of conversion and polymerization shrinkage of material with amorphous calcium phosphate. In addition to this, the remineralizing potential of the new formulation of composites based on amorphous calcium phosphate, which is based on the results of release of calcium and phosphate ions will be determined. Subsequently, the new materials will be compared with the existing commercial materials with mineral trioxide. The biocompatibility of experimental materials will be investigated.</p> <p>The ultimate aim of the research is to create a new bioactive composite material with the best properties of polymerization, the highest remineralization of carious lesions and without any toxic effects on the human body, which can be a solid base for further <i>in vivo</i> tests.</p>
	Investigation into the mutagenicity and gene mutation of restorative materials	<p>The mutagenic and cytotoxic properties of bioactive materials for repair and root canal filling and materials for compensation of dentin on pulpal progenitor cells, which will be directed to odontoblasts by differentiation, will be analyzed. The effect of platelet-rich plasma (PRP) on the differentiation of progenitor cells into odontoblasts will be studied as part of this research.</p>
	The use of lasers in dental medicine	<p>The effects of laser radiation on the bond strength between the composite materials and dentin and enamel as well as the bond strength between root canal filling materials and radicular dentin will be studied. The effectiveness of photodynamic therapy and laser-activated irrigation in the eradication of endodontic infection will be analyzed.</p> <p>The effectiveness of the use of lasers in the process of teeth whitening will be investigated. Also, the efficiency of erbium laser for ablation of dental hard tissues, or removal, depending on physical parameters will be investigated.</p>

Stem cell research, molecular research and regenerative dental medicine	Oral mucosa stem cells and dental pulp stem cells	The School of Dental Medicine strategic plan of scientific research aims at improving the investigation into the field of stem cells (SC). According to the plan, experiments will start with the purpose of isolation, characterization and evaluation of differentiation potential of oral tissues stem cells. The aim of the research is to isolate stem cells from the tissue samples of the oral mucosa (OM) (upon biopsy) and dental pulp (DP) (upon pulp extirpation) and characterize <i>in vitro</i> differentiation potential. 15 samples (OS N=10 and DP N = 5) will be collected from donors, from which the primary cultures of stem cells will be formed. The growth of cells will be measured and phenotype class will be determined by immunophenotypization. We expect to confirm the fact that it belongs to neural crest. By adding differentiation factors, we will determine in which lines of the three germ layers the oral SC can be differentiated. SC of OM <i>lamina propria</i> come from embryonic neural crest, hence they are expected to have a pluripotent potential. In order to confirm the pluripotent potential of isolated cells, the measurements of the level of expression of marker of undifferentiated cells (Oct4 and Sox2) and of pluripotency (Nanog) will be made, as well as the measurements of the marker of neural crest SC, p75.
	Investigations into the pulp revascularization after traumatic pulp injuries	The study is planned to examine the factors affecting revascularization of the pulp after dental trauma events. The effect of MTA on the differentiation of odontoblast cells of the human pulp and the effect of Biodentin will be compared and the role of photoactive disinfection and fibrin-rich thrombocytes in regenerative endodontics will be examined. The role of angiogenesis in endodontics will be studied: the role of stem cells and the role of proangiogenic and antiangiogenic factors in the regeneration of dental pulp.
	Proteomic analysis and metabolic proteomics in periodontology	In this research, the proteome of different types of periodontitis will be determined by use of high-throughput proteomics. The changes occurring in various forms of periodontal diseases before and after treatment will be quantified by use of label-free quantitative proteomic analysis Metabolic proteomic analysis of patients' tissues with various forms of periodontal diseases will be made before and after the treatment. The aims of this research are to get a deeper insight into the pathogenesis of periodontitis and to discover potential biomarkers of periodontitis. Based on the findings, we plan to develop animal models of periodontitis and, also, develop and use antibodies in order to stop periodontitis.
	Salivary diagnostics	A systematic study is planned in which saliva is used as a substrate for diagnostics. The ingredients of saliva will be analyzed and correlated with certain pathological conditions. The starting point is that saliva as a body fluid saliva is easily accessible in a non-invasive manner (in contrast to blood sampling) and that, under certain conditions, it can be a diagnostic blood substitute. Moreover, the metabolites and certain constituents of saliva may be specific markers of oral and systemic pathological conditions. Salivary markers of oral mucosa diseases (salivary cytokines), salivary opiorphins as markers of orofacial pain condition and salivary markers of the transformation of potentially malignant oral diseases will be investigated. The levels of tumor markers in saliva and correlation with the level in the blood, as well as levels of markers of cardiovascular disease in saliva and correlation with the level in the blood will be determined.
	Markers of oxidative stress and opiorphin in temporomandibular disorders	The markers of oxidative stress will be analyzed using ELISA method with spectrophotometry. In addition, opiorphin in saliva will be analyzed by the use of HPLC-MS / MS methods in patients with TMD. Also, the levels of salivary cortisol will be determined in the same patients using the electro chemiluminescent immunochemical technique with previous extraction. These parameters will be monitored in patients with TMD for six months using different methods of treatment. This is planned to gain insights into the mechanism of pathogenesis of temporomandibular disorders.
	Molecular biology of endodontic infection	The study will clearly define the microbial difference between primary, secondary and persistent endodontic infections. The role of individual bacterial species in certain clinical symptoms of endodontic infection will be examined. Also, this study will investigate the resistance of endodontic bacterial strains to antimicrobial agents and examine the effectiveness, reliability and applicability of certain molecular techniques to the study of the composition of the microflora of root canals in endodontic infections. Besides, the study will evaluate the effectiveness of antimicrobial protocol during endodontic infection. The aim of the research is to compare the resistance to antimicrobial agents which is exhibited by endodontic bacterial species in planktonic forms, by monobiofilm and by a multibacterial film. Subsequently, we plan to form an extraoral multibacterial biofilm on dentin tissue and visualize it using the Fluorescence <i>in situ</i> Hybridization technique (FISH). Also, one of the aims of the study is to investigate the association between individual bacterial species in primary, secondary and persistent infections and to compare the efficacy of antimicrobial agents and the efficacy of irrigation of the root canal systems using various molecular microbiological techniques.

Structures and functions of stomatognathic system	Morphological and biomechanical aspects of orthodontics	<p>This study aims to determine the shape and dimensions of dental arches in Croatian population. The odontometric and gnathometric features will be analyzed for this purpose.</p> <p>The influence of gender and age will be evaluated in odontometric and gnathometric analyses. The results will be compared with odontometric and gnathometric analysis of other population groups. The results of orthodontic therapy will be gnathometrically evaluated and the success of the orthodontic treatment as well as stability will be monitored. The systems for a 3D morphometric analysis of the teeth and dental arches will be created during research.</p>
	Anatomy, physiology and anthropology of stomatognathic system	<p>Anthropological and morphological characteristics of the teeth of recent and archaeological populations and physiological impact on the mechanism of tooth eruption will be investigated. Anatomic features of human palatine drawing and the features of lip drawing will be investigated. The aims of the research are to interpret specific anthropological and morphological characteristics of the teeth in the context of general health of the body, diet, and the use of teeth. Also, the aim of this research is to investigate whether there were any changes regarding tooth eruption in infants with premature birth. Also, the research aims to record the anatomical features of palatal drawings and anatomical features of lips drawings.</p>
	Forensic dentistry and pelestomatology	<p>The research on the age estimation of children and adults in recent population will be carried out using X-ray imaging. The research related to dental age estimation of adults will be carried out by the use of Raman spectroscopy technique.</p> <p>The aim is to examine the usability of palatal drawings for identification in forensic dentistry. Research on the oral health of the archaeological populations from Croatia will be conducted. The aim of this study is to get specific national standards for dental age estimation in children and adults based on radiographic analysis. Since tooth wear is widely accepted as a physiological consequence of aging, the degree of tooth wear will be recorded to estimate the age of Croatian adult population.</p> <p>The researchers will try to find a correlation between noticeable variability on Raman spectra and the chronological age of the subject.</p>
	Mineralized tissues	<p>In order to conduct a minimally invasive treatment of caries, a correct diagnostics of initial carious lesions is needed. Also, it is important to select dental materials the composition of which acts preventively and the properties of which meet the requirements of the specific conditions within the oral cavity. The study will compare the diagnosis of caries lesions made by visual-tactile examination with the diagnosis made by laser interferometry. The application of a biocompatible and bioactive substitute for dentin and the use of bioactive materials for arrestment of progression of carious lesions and remineralization will be examined. Physical and mechanical properties of Biodentin as modern bioactive material as well as its cytotoxicity and bond strength to hard dental tissues will be examined. The degree of demineralization and remineralization of dentin will be quantitatively determined using laser interferometry before and after application of bioactive materials.</p>
Epidemiology and public health	Epidemiology of caries and endodontic issues and periodontal diseases	<p>A systematic cross-sectional study of the prevalence of dental caries and periodontal disease, the prevalence of periapical disease as well as epidemiological studies on the quality of endodontic treatment will be conducted in order to determine the state of oral health of the Croatian population and thus develop a theoretical basis for planning public health care in the field of dental medicine. Interventional studies will try to find the most effective model for promoting oral hygiene measures in the Croatian population. It will also try to find a causal link between the quality of endodontic treatment and the incidence of periapical diseases.</p>
	Epidemiology of traumatic dental injuries in children and adolescents	<p>The study will determine the recent incidence of certain traumatic dental injuries in children and adolescents and try find whether there is an association between certain etiological factors. It will investigate the potential impact of obesity on dental injuries in children. Also, it will assess dental injuries resulting from sporting activities, that is, injuries sustained during athletic pursuits. The impact of various forms of leisure activities on the occurrence of dental injuries will be determined. A success rate of treatments of certain types of traumatic dental injuries will be analyzed. The incidence and prevalence of traumatic dental injuries in children and adolescents with special needs will be determined.</p>
	Improvement in oral health quality after different prosthetic and implant-prosthetic treatments	<p>From the patient's perspective, the success of the therapy has become important in evaluating the quality of life, hence the improvement in the quality of life, and not merely the absence of disease, has entered into the definition of human well-being by the WHO. Thus, patients with equal clinical status may receive different prosthetic treatments. Yet, the patient will not be equally satisfied with all options. In doing so, some options are short-term and some long-term, some options enable better preservation of bone tissue and a more correct formation of residual ridge. Some options prevent the absorption of the residual ridge and the like. The purpose of this research is to explore which modalities improve patient satisfaction and oral health quality of life and orofacial function, thus acting preventively on the consequences of partial or complete edentulousness. It also aims to determine which prosthetic and implant supported replacements are most cost-effective in the long run.</p>
	Epidemiological studies in implantology	<p>The research on the quality of implant therapy, then cross-sectional studies on the prevalence of peri-implantitis and the studies on the level of oral hygiene in implant dentistry patients will be carried out. The studies will examine the manner and level of education on oral hygiene in implant dentistry patients.</p> <p>The aim of this research is to determine the prevalence of implant supported restorative therapy in Croatian population and the incidence of complications related to the implant supported restorative therapy. The study will attempt to find a causal link between the quality of oral hygiene and complications after the implant supported restorative therapy. It will also determine the success of implant-prosthetic restorative therapy in medically compromised patients, with an emphasis on patients treated with bisphosphonates.</p>

6. ORGANIZATIONAL DEVELOPMENT PLAN OF THE SCIENTIFIC ORGANIZATION

Considering the extraordinary potential in scientific research staff, the School of Dental Medicine will systematically strengthen international and inter-institutional cooperation and persist in establishing a center for scientific research excellence in the field of dental and oral medicine and dental materials. Thus, as early as in 2016, the opening of a research central laboratory is planned, and researchers will be invited to state their needs for the equipment necessary in their research. One part of scientists of the School of Dental Medicine in Zagreb participated, together with the Institute

of Physics, in the application for the public call for scientific centers of excellence "RESEARCH AND TECHNOLOGY OF PLASMA". They will promote networking on the European and global level, in order to jointly work on research projects and innovation, and to improve the overall World fund of knowledge, while contributing to the prosperity of the Croatian society. They will further the research, and raise awareness about the importance of oral health, present results of research on oral health to the general public, and facilitate the application of scientific discoveries.

7. INDICATORS OF IMPLEMENTATION RESULTS OF THE STRATEGIC PROGRAM OF SCIENTIFIC RESEARCH FOR THE 5 YEAR PERIOD

The realization of the scientific activities of the School of Dental Medicine, which is shown in tables later in this chapter, is an indicator of successful implementation of the program.

Scientific research

Table 7.1. Scientific productivity

	Number of active research	Number of scientific and other papers in international journals	Number of textbooks and books	Number of participation in the organization of scientific meetings	Ratios of the number of scientific papers per doctor of science
2015	5	100	2	5	1,5
2016	5	100	2	5	1,5
2017	5	100	2	5	1,5
2018	7	100	2	5	2,0
2019	7	120	2	5	2,0

Scientific and professional education and training of doctoral students, postdoctoral students and other scientific and technical staff

Table 7.2. The structure of researchers at the School of Dental Medicine

	PhDs without scientific title	Research associates	Research scientists	Senior research scientists
2015	13	32	48	39
2016	15	26	40	47
2017	16	30	43	42
2018	16	31	52	48
2019	16	30	49	45

Table 7.3. Scientific and professional training, career empowerment

	Number of defended PhD dissertations	Number of study visits abroad lasting less than a month	Number of study visits abroad lasting one month or longer
2015	15	3	5
2016	15	3	5
2017	15	5	5
2018	15	5	5
2019	15	5	5

Providing scientific, consulting and professional services

Table 7.4. Networks between research, industry and the public sector

	Number of professional research projects	Number of professional papers	Number of professional workshops and lectures
2015	3	22	28
2016	3	24	30
2017	4	28	30
2018	4	30	30
2019	5	32	30

