

A light blue map of Croatia is centered on a dark blue background. The map shows the coastline and major islands of Croatia.

Education and Training of Medical Biochemists in Croatia

IFCC C-ECD
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What is the Usual Name for Clinical Biochemistry in Croatia?

- Medical biochemistry is the usual name for clinical biochemistry or clinical chemistry in Croatia
- Medical biochemist is the usual name for the clinical biochemist or clinical chemist in Croatia

What is Medical Biochemistry in Croatia?

- Medical biochemistry in Croatia is the largest sub-discipline of laboratory medicine
- It includes all aspects of biochemistry, and also includes laboratory hematology with coagulation, immunology, molecular diagnostics and analytical toxicology
- Medical biochemistry analysis can be performed in:
 - medical biochemistry laboratories
 - as a point of care testing
 - in the doctor's ward

The scope of activities is determined by the Law of the Medical Biochemistry Profession proposed by the Croatian Chamber of Medical Biochemists and issued by the Croatian State Assembly on July 17, 2003

Where Does a Medical Biochemist Work?

Medical biochemists in Croatia pursue a career in:

- Medical biochemistry laboratories and other medical laboratories in the Health Care System
- Pure and applied medical biochemistry research and/or education at the University and Research institute
- Industry – diagnostics, pharmaceutical, biotechnology

Position in Health Care System

Medical biochemistry laboratories in Croatia and medical biochemists as a profession are part of the Health Care System and their activities are regulated through:

- The Health Care Law
- The Law of the Medical Biochemistry Profession
- The Rules issued by the Croatian Chamber of Medical Biochemists
- The Law of the State and Private Health Insurance

Position in Health Care System (continued)

According to the number and complexity of the tests performed as well as to the qualifications of the personnel in laboratory team defined in the Law of the Medical Biochemistry Profession, medical biochemistry laboratories are:

- General (in a primary health care setting)
- Special (in an community or country hospital)
- Subspecial (in a special hospital or clinical hospital)
- Clinical (in a University clinical hospital)
- Clinical medical biochemistry laboratories as a part of the University hospitals are a teaching units for undergraduate and postgraduate education of medical biochemists
- Private laboratories are either general or special laboratories
- All medical biochemistry laboratories and the list of tests performed are licenced through the Ministry of Health

Position in Health Care System (continued)

The Health Care Law recognizes medical biochemist as one of four academically-educated personnel in health care:

- Doctor of Medicine
- Doctor of Dentistry
- Master of Pharmacy
- Graduate Medical Biochemist

What Does a Medical Biochemist Do?

Major responsibilities

- Supervision of comprehensive laboratory service including management, quality assurance and informatics
- Research in laboratory medicine for those employed in teaching hospitals, Institutes and the University
- Education of undergraduates and postgraduates, and continuing education of medical biochemists and other professions in the Health Care System

Requirements for Starting a Career in Medical Biochemistry

There are four requirements for practicing medical biochemistry in the Health Care System in Croatia:

- University Diploma of the Faculty of Pharmacy and Biochemistry (Study of medical biochemistry)
- Successful completion of the profession exam at the Ministry of Health after completion of one additional year of obligatory practical training (interim) in the medical biochemistry laboratories
- Membership in the Croatian Chamber of Medical Biochemists
- Licence for skilled work issued by the Croatian Chamber of Medical Biochemists

Members of the Laboratory Team and Their Education

Medical biochemist - specialist	<ul style="list-style-type: none">■ University Diploma - minimally 4 years Study of medical biochemistry at the Faculty of Pharmacy and Biochemistry■ Profession exam■ Specialization in medical biochemistry (4 years)
Medical biochemist	<ul style="list-style-type: none">■ University Diploma - minimally 4 years Study of medical biochemistry at the Faculty of Pharmacy and Biochemistry■ Profession exam
Higher laboratory technician	<ul style="list-style-type: none">■ 2-3 years program of laboratory medicine at the Politechnic■ Profession exam
Laboratory technician	<ul style="list-style-type: none">■ 4 years middle school for laboratory technicians■ Profession exam
Health coworker	<ul style="list-style-type: none">■ University Diploma minimally 4 years study at a Faculty, such as the Faculty of Natural Science, which does not belong to the biomedical group of faculties at the University■ Has a scientific degree but is not eligible to pass the profession exam and specialization exam

Members of the Laboratory Team and Their Responsibilities

Medical biochemist - specialist	<ul style="list-style-type: none"> ■ Comprehensive laboratory service in their area including management, quality assurance and informatics ■ Depending on the type of laboratory, perform routine and special tests ■ Sign and report results including advice in interpretation
Medical biochemist	<ul style="list-style-type: none"> ■ Comprehensive laboratory service in their area including management, quality assurance and informatics ■ Depending on the type of laboratory, perform routine tests ■ Sign and report results including advice in interpretation
Higher laboratory technician	<ul style="list-style-type: none"> ■ Sample accessioning and processing ■ Perform tests in the laboratory but not allowed to report test results ■ Making reagents
Laboratory technician	<ul style="list-style-type: none"> ■ Sample accessioning and processing, assist in the laboratory ■ Perform qualitative tests
Health cooworker	<ul style="list-style-type: none"> ■ Member of the research group in the clinical hospital laboratory

Members of the Laboratory Team and Where They Work

Medical biochemist - specialist	<ul style="list-style-type: none"> ■ In special, subspecial and clinical medical biochemistry laboratories ■ May work in any medical biochemistry laboratory
Medical biochemist	<ul style="list-style-type: none"> ■ All medical biochemistry laboratories ■ Sometimes in other medical laboratories
Higher laboratory technician	<ul style="list-style-type: none"> ■ All medical biochemical and other medical laboratories
Laboratory technician	<ul style="list-style-type: none"> ■ All medical biochemical and other medical laboratories
Health cooworker	<ul style="list-style-type: none"> ■ Clinical medical biochemical and other medical laboratories

Head of the Laboratory Team: Current Requirements

General medical biochemistry laboratory	<ul style="list-style-type: none">■ University Diploma - minimally 4 years Study of medical biochemistry at the Faculty of Pharmacy and Biochemistry■ Profession exam
Special medical biochemistry laboratory	<ul style="list-style-type: none">■ University Diploma - minimally 4 years Study of medical biochemistry at the Faculty of Pharmacy and Biochemistry■ Profession exam■ Specialization in medical biochemistry (4 years)
Clinical medical biochemistry laboratory	<ul style="list-style-type: none">■ University Diploma - minimally 4 years Study of medical biochemistry at the Faculty of Pharmacy and Biochemistry■ Profession exam■ Specialization in medical biochemistry (4 years)■ Ph.D. degree

University Undergraduate Study Program

- The program is designed for candidates who plan to pursue a career in medical biochemistry laboratories within the Health Care System or a career in pure and applied medical biochemistry research and education
- Creative work and research in medical biochemistry requires broad formal training in basic natural sciences and medicine and extensive laboratory experience

University Undergraduate Degree

The program has been designed to accommodate these educational goals through:

- Four years (8 terms) starting from 1963 with few improvements in the program. The successful candidate graduates with University Diploma (Graduate engineer in medical biochemistry)
 - Clin Chem Lab Med 1999; 37: 77-82
- Nine terms starting from 2002. The successful candidate graduates with University Diploma (Graduate engineer in medical biochemistry) (www.pharma.hr)
- Five years (10 terms) starting from 2005 according to the Bologna Declaration. The successful candidate graduates with University diploma (Master of medical biochemistry)

Graduate Degrees prior to 2005

- Faculty of Pharmacy and Biochemistry has been authorized by the Ministry of Science, Education and Sports to organize a 2-years postgraduate scientific program of study in medical biochemistry
- Passing the exams and defence of the master thesis, the candidate achieves a master degree (M.Sc.)
- Candidates have the possibility to continue for a further 3 - 5 years to complete the doctoral thesis requirements and achieve a Ph.D. degree

Graduate Degree (PhD) from 2005

- The introduction of the Bologna Rules in the University undergraduate education from 2005 changed the rules for achieving a Ph.D. degree.
- The new 3-year doctoral program containing basic, modular, methodological and elective subjects began in 2005 at the Faculty of Pharmacy and Biochemistry, University of Zagreb
- It often take 5 - 6 years to complete the thesis requirements
- The candidates graduate with a Ph.D. (Doctor of Philosophy) degree

Current Professional Program (Specialization)

- According to the Rules for Specialization in the Health Care System defined by the Ministry of Health, medical biochemists can specialize either in Medical Biochemistry or in Analytical Toxicology.
- Only medical biochemists graduated from the Faculty of Pharmacy and Biochemistry are eligible to proceed towards the further four-year specialization in medical biochemistry.

Current Professional Program (Specialization) (continued)

- Specialization in medical biochemistry takes four years, and is divided into two stages:
- Year 1: The subjects in the first year of postgraduate scientific study of medical biochemistry are accepted as the theoretical part of the specialization
- Years 2-4: Comprise residency, mainly in Departments of Laboratory Diagnostics in University Hospitals and partly in specialized medical biomedical laboratories in general or specialized hospitals. Laboratories are accredited for teaching graduates by the Ministry of Health according to the proposal of the Croatian Society of Medical Biochemists.

New Professional Program (Specialization)

- The proposal for the new 5-years program is awaiting approval of the Ministry of Health
- It comprises one year of Professional Study Courses and 4 years of residency in laboratories accredited for teaching graduates by the Ministry of Health according to a proposal of the Croatian Society of Medical Biochemists

Requirements for Continuing Education

- The Health Care Law issued by the Croatian Government in 1993 established a mandatory program of continuing professional education
- A variety of programs organized by various groups and other activities have been recognized as continuing education by The Rules of continuing education of medical biochemists issued by the Croatian Chamber of Medical Biochemists (www.hkmb.hr). Examples:
 - The Faculty of Pharmacy and Biochemistry (scientific degrees)
 - Croatian Society of Medical Biochemists (symposia, congresses)
 - Croatian Chamber of Medical Biochemists (courses)
 - Programs of other scientific societies
 - Research and publishing activity

Requirements for Continuing Education (continued)

- The Croatian Chamber of Medical Biochemists has been authorized by the Ministry of Health to issue a license for work to medical biochemists employed in the Health Care System
- The Licence of a medical biochemist is renewed every 6 years on the basis of successful completion of continuing education requirements during that period
 - Minimum requirement for renewal of the licence: 30 credits gathered from different types of the programs (specialization, courses, symposiums, congresses, publications ...)

Appendix

- Programs of the University undergraduate study (accepted from 2005)
- Programs of the University doctoral study program (waiting for approval)
- Program of specialization (waiting for approval)
- List of credits for approval of medical biochemists

Current University Undergraduate Study Program According to Bologna Declaration

Obligatory subjects (O)	Electives (E)	ECTS
1. year		
Introduction to the Study of Medical Biochemistry, Mathematics, Cell biology with the basiss of Genetics. Sociology and Health Care, General Chemistry with Stehiometry, Physiology with the basics of human anatomy, Cytology and Hystology, Physics, Statistics, Analytical chemistry ^x , Organic Chemistry ^x , Practicals in Health Care System	First Aid and security in the laboratory ^{xx} , Medical nomenclature ^{xx} , Communicational ability ^{xx} , Psychology ^{xx} , Health legislature ^{xx}	60
2. year		
Analytical chemistry, Organic chemistry, Biological chemistry, Physical chemistry, Microbiology with parasitology, Biochemistry ^x , Pathophysiology with the basics of pathology ^x , Immunology ^x , Human population genetics, Pharmaceutical chemistry, Practicals in the Health Care System	Selected methods of instrumental analysis, Spectrophotometric identificatio of organic compounds, Physical-chemical methods in biomedical investigations, Health ecology, Basis of epidemiology with microbiological diagnostics, bioethics	60
3. year		
Biochemistry ^x , Patophysiology with the basis of patology ^x , Immunology ^x , Physical biochemistry, Analytical and preparative biochemistry, General clinical biochemistry, Hematology, Molecular biology with genetic engineering, Pharmacology ^x , Practicals in Health Care System	Free radicals and antioxidants in health and diseases, Metalloproteins-structure and mechanisms, Culture of cells and cell lines, Biological membranes and cell signalling, Membrane transport and informations	60
^x Subject continues in the next year	^{xx} subject taken from programs of other faculties	

Current University Undergraduate Study Program According to Bologna Declaration (continued)

Obligatory subjects	Electives	ECTS
4. year		
Pharmacology ^x , Analytical toxicology, Coagulation, Clinical biochemistry of organs and organ systems, Molecular diagnostics, Biochemistry of drugs, Biochemistry of nutrition, Practicals in Health Care System	Neurochemistry, Emergency laboratory diagnostics, Biostatistics, Bioinorganic chemistry	60
5. year		
Transfusion medicine with imunoematology, Radionuclides in laboratory diagnostics, Evaluation of instruments, performance and reagents, Special topics of clinical biochemistry, Integrated subject of laboratory diagnostics with interpretation of the reports, Methods in scientific investigation, Organisation and management in the medical-biochemical laboratory, Diploma work, Practicals in Health Care System	Nutrition, Rational laboratory diagnostics, Point of care testing, Production of biochemicals, Standards of quality in laboratory medicine, Laboratory endocrinology, Genetics	60
^x Subject continues in the next year	^{xx} subject taken from programs of other faculties	

Proposed New Scientific (PhD study)

- **Basic subjects** (Biostatistics, Experimental disease models, Evidence based medicine, Bioetics, Research project) (4 ECTS)
- **Modular subjects** (Free radicals and antioxidants in the control of cell function, mechanism of lipoproteins-associated enzyme function, Biological membranes and molecular mechanisms of transport, Metabolic interrelationship and their control, The cytoskeleton, Cellular and molecular biology of cancer, New advances in laboratory diagnostics of coagulation disorders, Laboratory methods in endocrinology, Medical genetics, Cerebrospinal fluid in health and disease with the basic knowledge of neuroimmunology, Immunonopathogenesis and immunodiagnosis of autoimmune diseases, Metabolic and genetic alteration in diabetes and its experimental models, Molecular biochemistry of cardiovascular diseases (10 ECTS)
- **Methodological subjects** (Apoptosis-detection and quantification, EPR of the free radicals, Integrated drug discovery biochemical methods and technologies, Selected topics in bioanalytics, High performance electrophoretic methods in protein and lipoprotein research, Methods for determination of nitric oxides in biological systems, Spectrophotometric methods in biomedicine, Methodology for assesment of diagnostic accuracy of laboratory tests (4 ECTS)
- **Electives** (Drug discovery from idea to the clinicl use, Signalling pathways as therapeutic targets, Metalloproteins drud interaction, Dermopharmaceutics, nanotechnology in pharmacy and medicine, Molecular modeling of organic compounds, Genetic basis of cystic fibrosis, hemochromatosis and monogenic muscular diseases, Pathobiochemistry of alcoholism and psychoactive substances, Pharmacological genetic toxicology in mammalian models, Biochemical mechanism of toxicity, Immunological control of virus infection, Gene Therapy: experimental and clinical approach, Innovative agents in cancer prevention, Resistance of tumor cells to therapy-new strategies in tumor treatment, Mechanism of allergic reaction, Protein structure and function (18 ECTS)
- **Scientific activity** (144 ECTS)

Proposed New Professional Program (Specialization)

Lecture courses (12 months): Regulation of metabolism, Genetic informations, Biochemical and imunological pathology of the organs, Organization and management of the medical-biochemical laboratory, Analytical techiques in medical-biochemical laboratory, Molecular-biological methods in medical-biochemical laboratory, Laboratory diagnostics of poisoning, Laboratory hematology

Practicals (48 months):

- **Point of care testing** (12 months)
- **Medical biochemistry** (16 months)
 - Laboratory methods for the determination of proteins, lipoproteins, enzymes and vitamins (4 months)
 - Laboratory methods for the determination of hormones and similar components (4 months)
 - Laboratory methods for the determination of drugs and toxic compounds (2 months)
 - Complementary methods for the examinations in special body fluids (2 months)
 - Laboratory methods for the determination of inborn errors of metabolism (2 months)
 - Molecular diagnostics (2 months)
- **Hematology** (12 months)
 - Laboratory methods for the determination of erythrocytes pathology (2 months)
 - Immunohematology (1 month)
 - Laboratory methods for the determination of leucocytes pathology (3 months)
 - Laboratory methods for the determination of hemoragical disease and thrombosis (5 months)
 - Molecular diagnostics of hematological diseases (1 month)
- **Immunology** (6 months)
- **Microbiology** (2 months)

List of Credits for Approval of Medical Biochemists

Nr.	Type of the continuing education	Credits
1.	<i>Specialization in medical biochemistry</i> <i>Subspecialization in a special field of medical biochemistry</i>	25 6
2.	<i>Postgraduate scientific study in medical biochemistry with passed exams</i> <i>Postgraduate professional study with passed exams</i>	8 6
3.	<i>Course (category I) (organized by the Croatian Chamber of Medical Biochemist)</i> lecturer attendee	8 4-5
	<i>Other course types</i> lecturer attendee	8 2-3
	<i>Additional 6-day education for extended scope of the medical biochemistry analysis i(at a University Department, University Hospital or Clinical medical biochemistry laboratory)</i>	5
4.	<i>Congress or Symposium</i> lecturer or poster first author poster coauthors attendee	3 total 3 2
	<i>Regular Society session</i> lecturer attendee	2 1
	<i>Regular meeting at a University Department, University Hospital or University Hospital</i> lecturer attendee	1 0,5
	<i>Regular meeting at a General Hospital or Special Hospital</i> lecturer attendee	0,5 0,25
5.	<i>Article in a professional or scientific journal</i> first author coauthors	4 total 4
6.	<i>Master degree</i>	10
7.	<i>PhD degree</i>	15
8.	<i>Professional or scientific book</i> book chapter –first author book chapter – coauthors	15 8 total 8
9.	<i>Supervision of graduation thesis, MS thesis, PhD thesis, residency, head(s) of continuing education course or additional 6-day practical training)</i>	7
10.	<i>Patents in the field of medical biochemistry</i>	8