

SEMMELWEIS UNIVERSITY
FACULTY OF PHARMACY
DEPARTMENT OF ORGANIC CHEMISTRY
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<http://semmelweis.hu/orgchem/en/>

Director:
Dr. István Mándity, Ph.D.
Associate professor

GUIDELINES FOR STUDENTS

Academic Year 2022/2023

Welcome to Students of Organic Chemistry

The following pages provide information on the subject-matter of the main **Organic Chemistry** course, the literature recommended for the studies, themes proposed for the diploma work, and the evaluation of the student's progress. The introduction includes a short overview of the history and scientific activities of the Department.

Budapest, August 2022

István Mándity
Director

TEACHING STAFF

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Secretary of Students' Scientific Association: (36-1)-476-3600 / extension 53055

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Directors of Department:

Dr. Ottó Clauder	1957-1977
Dr. László Szabó	1977-1996
<i>Dr. Ákos Kocsis</i>	1996-1997 (acting director)
Dr. Péter Mátyus	1997-2016
<i>Dr. Gábor Krajsovsky</i>	2016-2017 (acting director)
Dr. István Mándity	2017-

History

The Department of Organic Chemistry was founded in 1957 and its first head was Prof. Ottó Clauder. The infrastructure of the Department (the students' and tutors' laboratories, the equipment for preparative work and the library) was gradually built up and finally a spectroscopic unit was established. In 1977, Prof. László Szabó took over as head of the Department and after it, in 1997 Dr. Ákos Kocsis was appointed as acting director. After that from 1997 Prof. Péter Mátyus was the head of the Department. Since 2016 to June 2017 Dr. Gábor Krajsovsky was the acting director. The present head of the Department is Dr. István Mándity.

Aim and structure of the teaching and research activities are summarized in the following paragraphs.

The aim of the education in organic chemistry is to create an organic chemical basis for subsequent subjects in the curriculum of students at the Faculty of Pharmacy. To attain this goal, besides the main lectures (112 hours in the 3rd and 4th semesters) and parallel laboratory practicals (110 hours) in organic chemistry, the Department offers a choice of a special course to its students (Drug Syntheses), and meanwhile, continuous enlargement of number of special courses is planned. The available methods based on Computational Chemistry and Molecular Modeling have been involved in the official education material since 1998. The teaching activities at the Department also include the introduction of selected students into research in organic and medicinal chemistry, the direction of diploma work and participation in the postgraduate (Ph.D.) education. The Department takes part in several international research and educational cooperation programmes (such as ERASMUS).

The Department additionally plays an important role in the postgraduate education of pharmacists, as organizer of the Medicinal Chemistry Programme, and offers a two-year postgraduate programme in Drug Research and Development.

The main research fields at the Department were the synthesis and chemical properties of heterocycles, including some natural products. In the last few years, important results have been achieved in the fields of synthesis strategies, including palladium-catalysed cross-coupling reactions of pyridazines and uracils, and mechanistic studies and the synthetic development of certain thermal rearrangement reactions. Another research field was at the Department involves medicinal chemistry with the design and synthesis of antiarrhythmic compounds, ligands of α -adrenoceptors and inhibitors of semicarbazide-sensitive amine-oxidase.

The Department cooperates in both research and education with several academic (e.g. the Semmelweis University Department of Pharmacodynamics, Department of Pharmacology and Pharmacotherapy, Department of Ophthalmology, and II. Department of Internal Medicine; Peter Pazmany Catholic University Faculty of Information Technology, the University of Debrecen, Pécs, and Szeged; the Hungarian Academy of Sciences Chemical Research Centre; the University of Vienna, Palermo, Cagliari, Universidad de CEU San Pablo (Madrid), National University Singapore); and industrial (Richter Gedeon, EGIS, Pannonpharma) organizations.

The main research profiles in the Department are involving primarily – preserving the departmental traditions at least partially – heterocyclic syntheses, preparation of compounds with chloride ion transporter effect, peptide chemistry, chemistry of bifunctional compounds, introduction of processes of „green chemistry” (such as use of solvents carbon dioxide neutral, elaboration of organic chemical reactions taking place in water, application of continuous-flow chemical technologies). The research work is facilitated by separation, spectroscopic and computational methods.

Website: <http://semmelweis.hu/orgchem/en/>

The Subject of Organic Chemistry

Aims of the Course

The course includes and discusses the state-of the art knowledge of synthetic and structural organic chemistry subjects to develop problem-solving skills for organic chemistry and biomolecular sciences. To satisfy the requirements of the Faculty of Pharmacy, the course in organic chemistry has two main purposes:

a) The presentation of modern concepts and subject-matter concerning the structures, syntheses, physical and chemical properties, structure – property relationships, and practical applications of organic compounds, with special emphasis on bioactive molecules. The presentation and practical applications of the most important methods and tools of organic chemistry.

b) To provide a solid molecular, organic chemical basis for subsequent subjects in the curriculum of students at the Faculty of Pharmacy.

Timetable of the Subject of Organic Chemistry

The subject of organic chemistry is included in both semesters of the second year of the curriculum of students at the Faculty of Pharmacy.

Number of lectures in the main course: 112 hours (4 hours per week).

Length of the practical course: 72 hours (6 hours every second week).

Number of seminars: 40 hours (3 hours every second week).

Schedule for the Academic Year 2022/2023

Faculty of Pharmacy

<https://semmelweis.hu/english/education/english-language-program/academic-calendars/>

First Semester

Registration Period: 30 August 2022

First day of the Semester (1st-4th Years): 5 September 2022

Last day of the Semester (1st-4th Years): 9 December 2022

5th Year: Practical training: 18 July 2022 – 16 September 2022

Semester for the 5th Year: 19 September 2022 – 9 December 2022

Examination period: 1st-5th Years 12 December 2022 – 27 January 2023

Second Semester

Registration Period: 23 January 2023 – 27 January 2023

First day of the Semester (1st-4th Years): 30 January 2023

Last day of the Semester (1st-4th Years): 12 May 2023

Semester for the 5th Year: 26 January 2023 – 26 May 2023

Examination period: 1st-4th Years 15 May 2023 – 30 June 2023

Holidays

Spring holiday: 3 April 2023 – 10 April 2023

National/public holidays:	31 October 2022
	1 November 2022
	15 October 2022 (Saturday) working day (instead of 31 October)
	14 March 2023 (11.00-13.00)
	15 March 2023
	1 May 2023

Research Students' Conference: 8 February – 9 February 2023 (2nd-5th Years)

Topics of the Main Lectures

First Semester

History and subject of organic chemistry. Atomic and molecular orbitals. Chemical bonds: localized and delocalized bonds, σ and π bonds. Qualitative molecular orbital theory of organic compounds. MO-LCAO method. Hybridization. The Lewis-Langmuir theory. Resonance. The valence bond method. Bond distance and bond energy. Conjugation: orbital structure of the allyl system and butadiene. Energy profile of reactions.

Classification of organic compounds. Principles of the IUPAC nomenclature. Nomenclature systems. Stereochemistry of organic compounds. Isomerism: constitutional isomerism and stereoisomerism. Configurational isomers. Compounds containing one centre of chirality. Conformational isomerism. Importance of stereochemistry in biological activity. Geometrical isomerism. The Cahn-Ingold-Prelog convention. Newman and Fischer projections. Tautomerism.

Saturated acyclic and cyclic hydrocarbons: constitution, conformation, preparation and reactions, physical and chemical properties. Mono- and disubstituted cycloalkanes. Organic halogen compounds: synthesis and physical, chemical and biological properties. Classification of chemical reactions. Electronegativity, ionic character. Structure-reactivity. Steric and electronic effects in organic compounds and reactions. Acidity and basicity of organic compounds. Alkylations. Reaction mechanisms. Survey of the principles of reaction kinetics: reactions of first and second order, parallel reactions, principle of the stationary state. Nucleophilic substitution in aliphatic (S_N1 , S_N2 , S_N' and S_{Ni}) and aromatic compounds, eliminations ($E1$, $E2$ and $E1cb$). Effects of substrate, reagent and reaction conditions (solvent and temperature), and stereochemical consequences (MO interpretation).

Alkenes, alkynes, and their cyclic analogues: synthesis and physical, chemical and biological properties. Geometric isomerism. Types of addition reactions. Addition to carbon-carbon double bonds. Interpretation of Markovnikov and anti-Markovnikov orientations. Radical reactions and their mechanisms. Addition vs. substitution. Polymerization. Diolefins. Diels-Alder reaction I. Woodward-Hoffmann rules I. Acetylenes: synthesis and physical, chemical and biological properties. Nucleophilic additions.

Linear and cyclic π -delocalized systems. Aromaticity and anti-aromaticity. Interpretation of concerted reactions. Aromatic hydrocarbons, nomenclature.

Mechanism and direction rules of electrophilic aromatic substitution. Aromatic halogen compounds. Aromatic nucleophilic substitution. Linear free energy relationship.

Organic compounds containing C-O or C-S single bonds (alcohols, phenols, ethers, thioanalogues, and their derivatives): syntheses and physical, chemical and biological properties. Protecting groups.

Amines, nitro and diazonium compounds: syntheses and physical, chemical and biological properties. Organophosphorus compounds.

Aldehydes and ketones: syntheses and physical, chemical and biological properties. Addition to the carbonyl group. C-H acids. Umpolung, synthon principle. (Enolates I.)

Carboxylic acids and their derivatives: nucleophilic reactions at the acyl carbon atom, physical, chemical and biological properties. (Enolates II.) Carbonic acid and derivatives.

Second Semester

Carbon-carbon bond forming reaction with palladium catalysis, organometallic compounds of zinc and magnesium. Inter- and intramolecular reactions.

Heterocyclic and heteroaromatic compounds. π -Electron-excessive and π -electron-deficient heteroaromatic compounds. Three-, four-, five- and six-membered rings containing one or more heteroatoms. Some benzo- and heterofused ring systems. Azepines, diazepines and azocines; Heterocyclic polyenes. Synthetic principles, reactivity, (electrophilic and nucleophilic reactions) and biological importance. Natural compounds:

Structures of nucleosides, nucleotides and nucleic acids.

Alkaloids, and some representative compounds of these classes.

Isoprenoid compounds (terpenoids, carotenoids, steroids).

Stereochemistry of the citric acid cycle. Vitamins. Sulfonamides. Woodward-Hoffmann rules II. Diels-Alder reaction II.

Polyfunctional organic compounds. Polymers: general properties, synthesis, structure. Carbohydrates. Stereochemistry of organic compounds containing more than one centre of chirality. Amino acids, peptides, proteins: syntheses (including solid-phase synthesis) and physical, chemical and biological properties. Determination of the amino acid sequence in peptides.

Optional courses:

Name Reactions in Organic Chemistry (14×2 hours)

In Spring semesters, for 2-4th year students

Lecturer: Dr. Andrea Czompa, Ph.D.

Brief course summary:

Description of the most important name reactions used in organic chemistry and discussion of their mechanism. The use of name reactions found in literature and modifications in order to prepare different compounds, like drugs or candidates. Detailed analysis of chemo-, regio- and enantioselective synthesis, flow chemistry, microwave reactions, one-pot, tandem and domino synthetic pathways.

List of teaching materials:

László Kürthy and Barbara Czakó: Strategic Applications of Named Reactions in Organic Synthesis, Elsevier Academic Press, 2005.

Bradford P. Mundy, Michael G. Eller, Frank G. Favaloro Jr.: Name Reactions and Reagents in Organic Synthesis, Second Edition, John Wiley & Sons, 2005.

Smith M. B., March J. Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 6th Edition, New York, Wiley-Interscience, 2007.

Jie Jack Li: Name Reactions, Fifth Edition, Springer International Publishing, 2014.

Schedule Practicals

First Semester

19 Sep – 23 Sep	Recrystallization of 4-bromoacetanilide. Melting point determination (presentation).
3 Oct – 7 Oct	Preparation and recrystallization of 4-bromoacetanilide.
17 Oct – 21 Oct	Synthesis of 4-nitrobenzoic acid.
2 Nov – 4 Nov	Synthesis of methyl-4-nitrobenzoate.
14 Nov – 18 Nov	Chromatography (TLC and column).
28 Nov – 2 Dec	Introduction into cheminformatics.
5 Dec – 9 Dec	Supplement. Inventory.

Second Semester

13 Feb – 17 Feb	Chemical bibliography and databases.
27 Feb – 3 Mar	Diethyl-(3,5-dimethylpyrrole-2,4-dicarboxylate).
13 Mar – 17 Mar	Cyclohexanone oxime and phthalimide.
27 Mar – 31 Mar	Acetylsalicylic acid.
17 Apr – 21 Apr	(<i>E,E</i>)-1,5-diphenylpenta-1,4-diene-3-one.
2 May – 5 May	Purification of ethyl acetate.
8 May – 12 May	Supplement. Inventory.

Schedule Seminars

First Semester

12 Sep – 16 Sep	Energetics, atomic and molecular orbitals. Tautomerism and mesomerism, type of isomers, mesomer resonance structures, hybridisation states. Classification of reagents: electrophilic, nucleophilic and radical. Type of organic reactions.
26 Sep – 30 Sep	Conformational isomerism of n-butane, stereochemistry. Chirality, nomenclature of chiral compounds, Fischer projection of amino acids. Prochirality, constitutopic, homotopic, enantiotopic and diastereotopic atoms, groups and surfaces.
10 Oct – 14 Oct	Substituted cyclohexane derivatives, chair conformers and relationship among them. Radical halogenation of alkanes, preparation of substituted olefins, addition reactions and their stereochemistry. Molecularity and kinetic order, kinetic and thermodynamic control. Aromatic, antiaromatic and non-aromatic systems. Synthesis of aromatic hydrocarbons, reactions of aromatic compounds.
24 Oct – 28 Oct	Stereochemistry of S_N2 and S_E2 reactions and interpretation of the transition state. Aliphatic and aromatic hydroxyl and halogen compounds: basic properties of substitution and elimination reactions and their mechanism.
7 Nov – 11 Nov	Preparations, applications and reactions of quinones and ethers. Organic sulfur compounds, preparations of sulfonamides, reactions. Chemical properties of amines, basicity, preparations, reactions, diazotation.
21 Nov – 25 Nov	Aldehydes and ketones. Addition to the carbonyl group. Reactions of α -hydrogen of aldehydes and ketones.
5 Dec – 9 Dec	Reactivity of carboxylic acids and their derivatives (acylation), reactions involving α -hydrogen. Carbonic acid derivatives.

Second Semester

6 Feb – 10 Feb	Nomenclature examples from semester I-II, nomenclature of heterocyclic compounds. https://mek.oszk.hu/17200/17281/17281.pdf
20 Feb – 24 Feb	Heterocyclic compounds – advanced synthetic routes and reaction pathways. 3-, 4- and 5-membered heterocycles.
6 Mar – 10 Mar	Heterocyclic compounds – advanced synthetic routes and reaction pathways. 6-, 7- and 8-membered heterocycles.
20 Mar – 24 Mar	Amino acids, peptides, proteins.
11 Apr – 14 Apr	Carbohydrates.
24 Apr – 28 Apr	Solving of advanced organic chemistry problems. Natural compounds: alkaloids.
8 May – 12 May	Woodward-Hoffmann rules, solving of organic chemistry problems from semester I-II. Isoprenoids and steroids – structure and preparations. https://mek.oszk.hu/17200/17281/17281.pdf

Requirements for Evaluation of Progress in Studies

Written semi-final examination at the end of the first semester

Students have to answer in a written form questions on the subject-matter of the main lectures, the introductory lectures to the practicals and the practicals themselves.

Written final examination at the end of the second semester

Students have to answer in a written form questions on the theoretical and practical subject-matter from both semesters. The subject-matter involves all topics involved in the main lectures and the introductory lectures to the practicals, and related topics not necessarily directly indicated in the list of questions.

Attendance on the classes

Any students must attend at least on 75% of the practices and the seminars.

Evaluation of the midterm test

At the mid-term tests (two/semester) students have to answer in a written form questions on the subject-matter of the main lectures, the practicals and the seminars, the dates of which are fixed at the beginning of the semesters. The value of the midterm test can be either ranging 2-5 or failed. If the test is failed or the student did not attend it, the student must attend the following makeup test. If the makeup test is failed, a second makeup test should be written. If any of the makeup tests reach the passmark, then the midterm test is accepted. If also the second makeup test is failed, the student does not get signature for the semester, they are not allowed to sit in the semi-final examination. Grades for the main and makeup mid-term tests of the same topic are not averaged.

Evaluation of the students' work on seminars

Course material for the seminars (problem sets) are provided in advance to the students. Students are expected to consult these materials before the respective seminars. Attendance is mandatory at the seminars. Missed seminars could be attended at the same week (with another group) upon prior permission from the leading instructor. If anyone has 2 or more absences from the seminars, they must pass a report from the topics of missing seminars, and this report must be accepted. Attendance on at least 75% of the practical course necessary for the signature by the end of the semester.

Practical course grade

On the basis of the attendance and the results described in the protocol, the performance of the practical tasks is validated by the signature of the leading instructor. If necessary, students may make up for missed or unsuccessful experiments at a proper time after preliminary agreement with the leading instructor at the end of the semester. Without permission, the repetition of unsuccessful experiments is not allowed. The presence of the student at the main lecture is a necessary requirement for a consultation.

Evaluation of the compounds is based on their yield and purity. The appropriate parts of the laboratory note-book should be prepared in advance and after the completion of each practical, the note-book should be submitted to the leading instructor, together with the product of the experiment.

At the beginning of each laboratory practical, students must write a short test on the theoretical and practical subject-matter of the experiment, in order to prove gaining proficiency of the subject-matter, consisting of simple questions. These short tests will be immediately corrected by the leading instructor. Success in this test is required before the practical work can be started. If the test is not successful, the preparation in question can be performed only at the end of the semester, if the short test written then is accepted.

Conditions for acceptance of the preparations: you must reach at least 50% of the usual chemical yield, provided in the prescription:

0-49.9%:	1
50-62.4%:	2
62.5-74.9%:	3
75-87.4%:	4
87.5%-:	5

There are further conditions:

- melting range of the crystalline product can not be more than 10°C less, compared to the literature melting range
- acceptance of the notebook.

The leading instructor can change the actual mark on a range of +1/- 1, according to the quality of the notebook. The **mark of preparations** will be the simple average of marks of the preparations. At least 75% preparations must be completed by at least passmark.

Evaluation of non-preparative practices will be carried out by providing marks in a range of 1 to 5.

The **practical mark** of the Semester will be calculated, as a weighted average of the following 2 values, rounded to a number without decimals:

- 30% average mark of preparations
- 70% mark of midterm test

Requirements for successful completion of the semester

1. The midterm test must reach passmark.
2. Attendance on at least 75% of the seminars necessary for the signature by the end of the semester.
3. The grade for the practical course must be at least 2.

System of examinations

Students are allowed to sit in intermediate examinations only if they have obtained at least a passmark for the **practical course**. Examination dates will be set one month before the starting of the examination period, and students must register themselves for an appropriate date before the beginning of the examination period. Postponement of the examination is allowed only if the student has obtained permission previously - within two days before the examination - from the educational secretary of the Department, or if a written medical certificate is provided. Otherwise, any absence from the exam decreases the number of the chances they can have in organic chemistry. A request for postponement is possible by discussion with the educational secretary, either personally or by phone or by email.

Failed examinations may be repeated not sooner than on the 3rd day following the unsuccessful examination only (unless exceptional permission is granted by the Head of the Department). Re-sits of intermediate examinations will be on set dates.

The same examination rules are valid for students on CV course. If a student attends on a CV course for Organic chemistry I, then they must complete this course with combined examination at the beginning of the following examination period, then they are allowed to sit in the final combined examination. If a student attends on a CV course for Organic chemistry II, then they must complete this course with combined examination.

At the end of the semester, students must clean the contents of their cupboards. The schedule of the practicals, introductory lectures and seminars is listed in the written material provided.

Students of Foreign Language Programs at Semmelweis University, Important Message (http://khtweb.semmelweis.hu/angol/beiratkozas/dokumentumok/Declaration_2016.pdf)

In recent years, Semmelweis University has built a valuable student community by maintaining high academic standards and placing much emphasis on the ethical integrity of our education. The overwhelming majority of our students appreciate our efforts. Unfortunately, a small minority does not want to accept our ethical guidelines, and tries to take undue advantage at exams by using unacceptable techniques. We therefore do implement the following sanctions: Students who are found at exams possessing forbidden items, including electrical devices, such as mobile phones, i-pods, etc., will automatically and immediately be discharged with disgrace from Semmelweis University. By implementing this rule, we wish to preserve the academic and material value of the Semmelweis Diploma. Starting from the next academic year, our students will be obliged to sign a declaration in which they state to abide by this rule.

Dr. Mark Kollai
director, Foreign Students' Secretariat

Code of Conduct of Semmelweis University:

http://semmelweis.hu/jogigfoig/files/2018/11/Etikai_Kodex_hataly_2017XII09_tol_ENG.pdf

Syllabus for the Semi-Final Examination

- 1/ Chemical bond. Basic terms. Atomic and molecular orbitals. Hybridization. Bond formation and dissociation energy, with some typical examples. Isoconjugation.
- 2/ Basic terms of description of chemical bond – conjugation: butadiene, allyl systems; hyperconjugation. Homolysis and heterolysis. Resonance theory.
- 3/ Types of tautomers, with examples. Classification of protecting groups. Protecting groups of amino and hydroxy compounds.
- 4/ Nomenclature systems with examples. Rules for selection of the principal chain.
- 5/ Kinetics and thermodynamic principles; kinetic and thermodynamic control. Classification of organic reactions. Molecularity and order of reactions.
- 6/ Nomenclature and structures of alkanes, constitutional isomerism; conformational isomerism of ethane and butane.
- 7/ Preparation of alkanes by synthetic methods, characteristics of homologous series and physical and chemical properties of alkanes. Reactivity and selectivity, Hammond's Principle for radical halogenation of alkanes.
- 8/ Synthesis and stereochemistry of alicyclic compounds. Strains in alicyclic compounds. Some important cycloalkanes and their derivatives.
- 9/ Nomenclature of alkenes. (*E*) and (*Z*) isomers: geometric isomers. Structures and preparation of alkenes by synthetic methods. Physical and chemical properties of alkenes. Addition and oxidation reactions.
- 10/ Elimination reactions. E1, E2 and E1cb reaction mechanisms. The main characteristics of S_N1 and S_N2 reactions and of S_N' and S_Ni reactions. Factors influencing elimination and substitution reactions of aliphatic compounds.
- 11/ Diolefins. Cumulated, conjugated and isolated dienes. Preparation and chemical reactions. Woodward-Hoffmann Rules.
- 12/ Structures, preparation, physical and chemical properties of alkynes. Petroleum and natural gas.
- 13/ Aliphatic and aromatic halogen compounds. Nomenclature, preparation, physical and chemical properties of aliphatic and aromatic halogen compounds. Phase-transfer catalysis: principle and examples.
- 14/ Alcohols: nomenclature, preparation, acidity, physical and chemical properties. Optical isomerism. More important alcohol derivatives with one or more OH groups.
- 15/ Phenols: nomenclature, preparation, acidity, physical and chemical properties. More important phenol derivatives with one or more OH groups. Ethers, crown ethers and quinones.
- 16/ Symmetry elements in organic compounds. Representation and notation of configuration – Cahn-Ingold-Prelog system. Enantiomers, diastereomers, racemic and meso compounds. Prochiral molecules, enantiotopic and diastereotopic surfaces.
- 17/ Organic amino compounds. Structures, nomenclature and preparation.
- 18/ Basicity and acidity of aliphatic and aromatic amines. Influence of the medium. Structures of amine oxides and ylides. Some more important aliphatic, aromatic and arylalkanolamines.
- 19/ Comparative discussion of the chemical properties of amines.
- 20/ Organic nitro compounds.
- 21/ Organic compounds containing C-S bond(s). Sulfonic acids and sulfonamides.
- 22/ Organic compounds containing C-P bond(s).
- 23/ Definition of aromaticity (thermodynamic and structural aspects). Hückel's and Möbius's terms of aromaticity. Aromatic and antiaromatic compounds. Extension of aromaticity to systems different from benzene.

- 24/ Mechanism and direction rules of electrophilic aromatic substitution. Linear functions of free enthalpy.
- 25/ Chemical reactions of benzene with examples. Preparations of benzene homologues. Isomerism and nomenclature of benzene derivatives. Coal tar.
- 26/ Fused and isolated polycyclic hydrocarbons: structure and preparation.
- 27/ Factors affecting the acidity and basicity of organic compounds. Electronic effects in organic compounds.
- 28/ Aromatic diazonium compounds, preparation and chemical reactions. Aromatic azo compounds, diazomethane.
- 29/ Structure, reactivity and methods for preparation of aliphatic and aromatic aldehydes.
- 30/ Structures, reactivity and methods for preparation of aliphatic and aromatic ketones.
- 31/ Carbonyl compounds: mechanisms of nucleophilic addition reactions, addition to α,β -unsaturated carbonyl compounds.
- 32/ Aldehydes and ketones: stereochemical aspects of nucleophilic addition reactions. Aldehydes and ketones: oxidation and reduction.
- 33/ Tautomerism of aldehydes and ketones. Electrophilic substitution on α -carbon of carbonyl compounds. Aldol type reactions. Preparation of hydroxyoxo and dioxo compounds.
- 34/ Carboxylic acids and their derivatives: classification, physical properties, preparation and chemical properties of carboxylic acids. Important carboxylic acids.
- 35/ Carboxylic acids and their derivatives: mechanism of acylation reactions. Preparation and chemical reactions of acyl halides, anhydrides, esters and ketene.
- 36/ Mechanisms of preparation and hydrolysis of esters. Amides and nitriles, acid azides, acid hydrazides and hydroxamic acids. Preparation and chemical reactions of ortho esters.
- 37/ Electronic effects and interconversion of carboxylic acids and their derivatives: acylation reactions, reactivity order in acylation reactions and its interpretation, with examples.
- 38/ Carboxylic acids and their derivatives: reactions on the α -carbon. Halogenation, intermolecular and intramolecular Claisen condensation.
- 39/ Preparation, chemical properties and synthetic values of ethyl acetoacetate and diethyl malonate.
- 40/ Carbonic acid derivatives.
- 41/ Halogenated carboxylic acids and dicarboxylic acids: preparation and chemical properties of them.
- 42/ Hydroxycarboxylic acids and oxocarboxylic acids: preparation and chemical properties of them.

Syllabus for the Final Examination

- 1/ Chemical bond. Basic terms. Atomic and molecular orbitals. Hybridization. Bond formation and dissociation energy, with some typical examples. Isoconjugation.
- 2/ Basic terms of description of chemical bond – conjugation: butadiene, allyl systems; hyperconjugation. Homolysis and heterolysis. Resonance theory.
- 3/ Nomenclature systems with examples. Main types of heterocycles.
- 4/ Kinetics and thermodynamic principles; kinetic and thermodynamic control. Classification of organic reactions. Molecularity and order of reactions.
- 5/ Nomenclature and structures of alkanes, constitutional isomerism; conformational isomerism of ethane and butane.
- 6/ Preparation of alkanes by synthetic methods, characteristics of homologous series and physical and chemical properties of alkanes. Reactivity and selectivity, Hammond's Principle for radical halogenation of alkanes.
- 7/ Synthesis and stereochemistry of alicyclic compounds. Strains in alicyclic compounds. Some important cycloalkanes and their derivatives.
- 8/ Comparative discussion of inter- and intramolecular reactions (enthalpy and entropy). Steric acceleration and steric hindrance.
- 9/ Nomenclature of alkenes. (*E*) and (*Z*) isomers: geometric isomers. Structures and preparation of alkenes by synthetic methods. Physical and chemical properties of alkenes. Addition and oxidation reactions.
- 10/ Elimination reactions. E1, E2 and E1cb reaction mechanisms. The main characteristics of S_N1 and S_N2 reactions and of S_N' and S_Ni reactions. Factors influencing elimination and substitution reactions of aliphatic compounds.
- 11/ Diolefins. Cumulated, conjugated and isolated dienes. Preparation and chemical reactions. Woodward-Hoffmann Rules.
- 12/ Structures, preparation, physical and chemical properties of alkynes. Petroleum and natural gas.
- 13/ Aliphatic and aromatic halogen compounds. Nomenclature, preparation, physical and chemical properties of aliphatic and aromatic halogen compounds. Phase-transfer catalysis: principle and examples.
- 14/ Alcohols: nomenclature, preparation, acidity, physical and chemical properties. Optical isomerism. More important alcohol derivatives with one or more OH groups.
- 15/ Phenols: nomenclature, preparation, acidity, physical and chemical properties. More important phenol derivatives with one or more OH groups. Ethers, crown ethers and quinones.
- 16/ Symmetry elements in organic compounds. Representation and notation of configuration – Cahn-Ingold-Prelog system. Enantiomers, diastereomers, racemic and meso compounds. Prochiral molecules, enantiotopic and diastereotopic surfaces.
- 17/ Organic amino compounds. Structures, nomenclature and preparation.
- 18/ Basicity and acidity of aliphatic and aromatic amines. Influence of the medium. Organic nitro compounds.
- 19/ Comparative discussion of the chemical properties of amines. Structure of amine-oxides and ylides. Some more important amines and aminoalcohols.
- 20/ Organic compounds containing C-S bond(s). Sulfonic acids and sulfonamides.
- 21/ Organic compounds containing C-P bond(s). Use of organic compounds containing zinc, magnesium for organic syntheses. Suzuki cross coupling reaction.
- 22/ Definition of aromaticity (thermodynamic, structural and spectroscopic aspects). Hückel's and Möbius's terms of aromaticity. Aromatic and antiaromatic compounds. Extension of aromaticity to systems different from benzene.

- 23/ Mechanism and direction rules of electrophilic aromatic substitution. Linear functions of free enthalpy.
- 24/ Chemical reactions of benzene with examples. Preparations of benzene homologues. Nucleophilic substitution reactions of heteroaromatic halogen compounds. Isomerism and nomenclature of benzene derivatives. Coal tar.
- 25/ Factors affecting the acidity and basicity of organic compounds. Electronic effects in organic compounds. Classification of protecting groups. Protecting groups of amino and hydroxy compounds.
- 26/ Aromatic diazonium compounds, preparation and chemical reactions. Aromatic azo compounds, diazomethane.
- 27/ Fused and isolated polycyclic hydrocarbons: structure and preparation.
- 28/ Structure, reactivity and methods for preparation of aliphatic and aromatic aldehydes.
- 29/ Structures, reactivity and methods for preparation of aliphatic and aromatic ketones.
- 30/ Carbonyl compounds: mechanisms of nucleophilic addition reactions, addition to α,β -unsaturated carbonyl compounds.
- 31/ Aldehydes and ketones: stereochemical aspects of nucleophilic addition reactions. Aldehydes and ketones: oxidation and reduction.
- 32/ Tautomerism of aldehydes and ketones. Electrophilic substitution on α -carbon of carbonyl compounds. Aldol type reactions. Preparation of hydroxyoxo and dioxo compounds.
- 33/ Carboxylic acids and their derivatives: classification, physical properties, preparation and chemical properties of carboxylic acids. Important carboxylic acids.
- 34/ Carboxylic acids and their derivatives: mechanism of acylation reactions. Preparation and chemical reactions of acyl halides, anhydrides, esters and ketene.
- 35/ Mechanisms of preparation and hydrolysis of esters. Amides and nitriles, acid azides, acid hydrazides and hydroxamic acids. Preparation and chemical reactions of ortho esters.
- 36/ Electronic effects and interconversion of carboxylic acids and their derivatives: acylation reactions, reactivity order in acylation reactions and its interpretation, with examples.
- 37/ Carboxylic acids and their derivatives: reactions on the α -carbon. Halogenation, intermolecular and intramolecular Claisen condensation.
- 38/ Preparation, chemical properties and synthetic values of ethyl acetoacetate and diethyl malonate.
- 39/ Carbonic acid derivatives.
- 40/ Carbohydrates: structure (configuration and conformation) and its representation. Reactions of the carbonyl group.
- 41/ Carbohydrates: chemical reactions of the hydroxy groups. Anomeric effect. Glycosides.
- 42/ Preparation and chemical properties of amino acids. Protecting groups. Principles of peptide synthesis and synthetic methods.
- 43/ Sequence determination of peptides. Structure of proteins.
- 44/ Halogenated carboxylic acids and dicarboxylic acids: preparation and chemical properties of them.
- 45/ Hydroxycarboxylic acids and oxocarboxylic acids: preparation and chemical properties of them.
- 46/ Nomenclature system of heterocyclic compounds (with examples). Preparations and chemical reactions of alkylated derivatives of heteroaromatic compounds with examples.
- 47/ Preparations of π -excessive aromatic heterocyclic compounds with one heteroatom.
- 48/ Preparations of π -excessive aromatic heterocyclic compounds with 2 heteroatoms, having at least one nitrogen as heteroatom.
- 49/ Reactivity in electrophilic and nucleophilic substitution reactions as well as acid-base properties of π -excessive aromatic heterocyclic compounds with 1 or 2 heteroatoms, having at least one nitrogen atom.

- 50/ Preparations of π -deficient aromatic heterocyclic compounds with one heteroatom.
- 51/ Preparations of π -deficient aromatic heterocyclic compounds with 2 heteroatoms, having at least one nitrogen as heteroatom.
- 52/ Reactivity in electrophilic and nucleophilic substitution reactions as well as acid-base properties of π -deficient aromatic heterocyclic compounds with 1 or 2 heteroatoms, having at least one nitrogen atom.
- 53/ Types of tautomerism in heterocyclic compounds. Double reactivity of azinone, diazinone and similar systems.
- 54/ Benzo-fused analogues of five- and six-membered aromatic heterocycles.
- 55/ Three-, four-, seven- and eight-membered nitrogen-containing heterocycles: structures, chemical reactivity and pharmaceutical importance.
- 56/ Alkaloids generally. Terms of proto-, pseudo- and real alkaloids. I. Alkaloids derived from aliphatic amino acids (a/ protoalkaloids with N in chain: ephedrine, pseudoephedrine; b/ alkaloids with pyridine-, piperidine- and pyrrolidine skeleton; c/ alkaloids with tropane skeleton). II. Alkaloids derived from aromatic amino acids (a/ alkaloids with phenylethylamine skeleton: hordenine, mescaline; b/ alkaloids with isoquinoline skeleton; c/ alkaloids with morphine skeleton).
- 57/ Isolation of alkaloids. Some more important biogenic amines. III. Alkaloids derived from heterocyclic amino acids (tryptophan) (a/ alkaloids with indole skeleton; b/ alkaloids with rubane skeleton; c/ alkaloids with ergoline skeleton; d/ other alkaloids: tabersonine, camptothecine).
- 58/ Isoprenoid structures with some examples. Nomenclature of steroids. Bioactive steroids (with examples).
- 59/ Nucleosides and nucleotides. DNA and RNA bases.

Practical work.

Students should bear in mind that the subject-matter of the examination comprises the total subject-matter of the lectures, with special attention to examples from medicinal chemistry discussed in the practicals and seminars, even if they are not directly indicated in the syllabus. At the final examinations, students should also know the subject-matter involved in the practicals.

For the examinations, students should also revise the following basic concepts of other chemical courses: acids and bases, reaction kinetics, order and molecularity of reactions, Arrhenius equation, basic concepts of thermodynamics, entropy, enthalpy, activation parameters, and related concepts and topics.

Recommended textbooks

Materials of the lectures and practices can be downloaded from **Moodle**

P.C. Vollhardt; N.E. Schore: Organic Chemistry: Structure and Function, 8th Edition (W. H. Freeman)

D.R. Klein: Organic Chemistry, 3rd Edition (Wiley)

K.L. Williamson, K.M. Masters: Techniques Labs for Macroscale and Microscale Organic Experiments, 7th Edition (Cengage Learning)

Additional materials

Experimental Organic Chemistry for students at the 2nd year of the Faculty of Pharmacy-Compiled by teaching staff of Department of Organic Chemistry under the supervision of Péter Mátyus. Department of Organic Chemistry, 2012

Gábor Krajsovsky: Heterocyclic compounds
Semmelweis University, Pharmaceutical Faculty, Department of Organic Chemistry, 2018
Editor: Gábor Krajsovsky
ISBN: 978-615-5722-01-1
<http://mek.oszk.hu/19100/19197>

Gábor Krajsovsky: Collection of Organic chemical problems
Semmelweis University, Pharmaceutical Faculty, Department of Organic Chemistry, 2017
Editor: Gábor Krajsovsky
ISBN 978-963-06-5345-9
<http://mek.oszk.hu/17200/17281/>

László Szabó, Gábor Krajsovsky: Isomerism in Organic Compounds
Semmelweis University, Pharmaceutical Faculty, Department of Organic Chemistry, 2017
Editor: Gábor Krajsovsky
ISBN 978-963-12-9206-0
<http://mek.oszk.hu/17200/17283/>

Diploma Work

Aims of diploma work

In case of experimental work: obtaining expertise in organic chemical preparative work and in methods of electronic searches of the literature.

In case of computer chemical and modelling work: mastering and application of the most important methods.

Requirements of diploma work

The diploma work should include the literature references (minimum 30) relevant to the subject.

The diploma work must contain a minimum of 40 pages. The cover page should indicate the words "Diploma Work", the relevant year and the name of the student. The first inner page should give the title of the work, the name of the student and the place and year of elaboration.

Preparation of diploma work

The student may select freely from among the themes offered by the Department. With preliminary approval of the Head of the Department, the student may choose a subject different from those proposed officially. The diploma work should preferably be written in English or otherwise in German.

After the student has chosen a topic this must be reported to the Head of the Department not later than 15 October in the fourth academic year. After approval of the selection, the Head of the Department registers it and appoints a supervisor to help with the work. The supervisor may be an external expert. The student is required to consult with the supervisor at least three times. At the first consultation (not later than 15 December in the fourth academic year), the supervisor informs the student about the requirements of the diploma work and its main characteristics. At the second consultation (by 15 May in the fourth academic year), the student reports on the work accomplished and at the third consultation (not later than 15 November in the fifth academic year), the supervisor evaluates the work and gives instructions as to the final form.

After coordination with and final approval by the supervisor and the Head of the Department, two bound copies of the complete diploma are presented to the Department by 15 December in the fifth academic year. The reviewer appointed by the Head of the Department evaluates the work in written form, using a five-scale grading system.

The diploma work is defended in the presence of an examining board, the members of which are the Head of the Department or a deputy, the supervisor and the reviewer. Participation in the defence is open to the teaching staff and students of the University.

If the diploma work is not accepted (grade: 1), the Department informs the student, who is not allowed to take the general board examinations. A new or revised diploma work may be submitted, but not within 2 months.

Students may receive exemption from writing a diploma work if they have won a Rector's prize for an essay competition or published an article (written by one or two students) in a scientific journal (generally with an impact factor). Exemption must be requested in writing from the Dean of the Faculty. The Dean asks for the opinion and grading of the Department.

List of themes for diploma / research students work for Year of 2022/2023

1. Solid phase synthesis, purification and quality checking of biologically active peptide. (István Mándity)
2. Synthesis and applications of (quinoline) photoremovable protecting groups (Petra Dunkel)
3. Examinations of interactions of cell penetrating peptide with lipid membrane, by using theoretical chemical calculations (Balázs Balogh, István Mándity)
4. Development of artificial peptides (István Mándity)

Work of research students

If students have a keen interest in the organic chemical and drug chemical preparative or computational work at the Department, pass their final examination in organic chemistry with a mark not lower than 3, and have sufficient free time for additional work, they may request admission into the Union of Research Students of the Department. Further information can be obtained from the Secretary of the Union of Research Students or the Head of the Department.

<http://semmelweis.hu/tdk/en/>

Postgraduate work towards a Ph.D. degree

Students who have completed their undergraduate studies, received a diploma in pharmacy and have special interest in research work in the field of organic chemistry may continue their studies towards obtaining the scientific degree of Ph.D. (Doctor of Philosophy) at the University. Additional information may be obtained from the Head of the Department.

Title of the programme: *Modern research trends in pharmaceutical sciences.*

1. Synthesis and applications of photoremovable protecting groups
(supervisor: Dr. Petra Dunkel Ph.D.)
2. Chloride-ion transporter synthesis using micro-flow reaction system, peptide conformation analysis using NMR, MS, CD, UV measurements
(supervisor: Dr. István Mándity Ph.D.)

<http://semmelweis.hu/phd/en/>

Selected Publications

2010-2022

www.mtmt.hu

1. Dunkel P., Túrós Gy., Bényei A., Ludányi K., Mátyus P.:
Synthesis of novel fused azecine ring systems through application of the *tert*-amino effect.
Tetrahedron, **66**, 2331-2339 (2010).
IF 3.011
2. Haider N., Hochholdinger I., Mátyus P., Wobus A.:
Synthesis of *ortho*-functionalized 4-aminomethylpyridazines as substrate-like semicarbazide-sensitive amine oxidase inhibitors.
Chem. Pharm. Bull., **58**, 964-970 (2010).
IF 1.507
3. Földi Á.A., Ludányi K., Bényei A.Cs., Mátyus P.:
tert-Amino effect in *peri*-substituted naphthalenes: Syntheses of naphthazepine and naphthazonine ring systems.
Synlett, **14**, 2109-2113 (2010).
IF 2.447
4. Énzsöly A., Dunkel P., Récsán Zs., Győrffy H., Tóth J., Marics G., Bori Z., Tóth M., Zelkó R., Di Paolo M.L., Mátyus P., Németh J.:
Preliminary studies of the effects of vascular adhesion protein-1 inhibitors on experimental corneal neovascularization.
J. Neural. Transm., **118**, 1065-1069 (2011).
IF 2.732
5. Pop L.A., Czompa A., Paizs Cs., Tosa M.I., Vass E., Mátyus P., Irimie F.D.:
Lipase catalyzed synthesis of both enantiomers of 3-chloro-1-phenylpropan-1-ols.
Synthesis, **18**, 2921-2928 (2011).
IF 2.466
6. Dunkel P., Balogh B., Meleddu R., Maccioni E., Gyires K., Mátyus P.:
Semicarbazide sensitive amine oxidase/vascular adhesion protein-1: A patent survey.
Expert Opin. Ther. Patents, **21**, 1453-1471 (2011).
IF 3.571
7. Maccioni E., Alcaro S., Cirilli R., Vigo S., Cardia C. M., Sanna M.L., Meleddu R., Yanez M., Costa G., Casu L., Mátyus P., Distinto S.:
3-Acetyl-2,5-diaryl-2,3-dihydro-1,3,4-oxadiazoles: A new scaffold for the selective inhibition of monoamine oxidase B.
J. Med. Chem., **54**, 6394-6398 (2011).
IF 5.248
8. Dunkel P., Chai C.L.L., Sperlágh B., Huleatt P.B., Mátyus P.:
Clinical utility of neuroprotective agents in neurodegenerative diseases: Current status of drug development for Alzheimer's, Parkinson's and Huntington's diseases, and amyotrophic lateral sclerosis.
Expert Opin. Investig. Drugs, **21**, 1267-1308 (2012).
IF 4.744

9. Bottino P., Dunkel P., Schlich M., Galavotti L., Deme R., Regdon G. Jr., Bényei A., Pintye-Hódi K., Ronsisvalle G., Mátyus P.:
Study on the scope of *tert*-amino effect: New extensions of type 2 reactions to bridged biaryls.
J. Phys. Org. Chem., **25**, 1033-1041 (2012).
IF 1.578
10. Ilić M., Ilaš J., Dunkel P., Mátyus P., Bohác A., Liekens S., Kikelj D.:
Novel 1,4-benzoxazine and 1,4-benzodioxine inhibitors of angiogenesis.
Eur. J. Med. Chem., **58**, 160-170 (2012).
IF 3.499
11. Arany Á., Bolgár B., Balogh B., Antal P., Mátyus P.:
Multi-aspect candidates for repositioning: Data fusion methods using heterogeneous information sources.
Curr. Med. Chem., **20**, 95-107 (2013).
IF 3.715
12. Tábi T., Szökő É., Mérey A., Tóth V., Mátyus P., Gyires K.:
Study on SSAO enzyme activity and anti-inflammatory effect of SSAO inhibitors in animal model of inflammation.
J. Neural Transm., **120**, 963-967 (2013).
IF 2.871
13. Ilić M., Dunkel P., Ilaš J., Chabielska E., Zakrzeska A., Mátyus P., Kikelj D.:
Towards dual antithrombotic compounds – Balancing thrombin inhibitory and fibrinogen GPIIb/IIIa binding inhibitory activities of 2,3-dihydro-1,4-benzodioxine derivatives through regio- and stereoisomerism.
Eur. J. Med. Chem., **62**, 329-340 (2013).
IF 3.432
14. Bolgár B., Arany Á., Temesi G., Balogh B., Antal P., Mátyus P.:
Drug repositioning for treatment of movement disorders: From serendipity to rational discovery strategies.
Curr. Top. Med. Chem., **13**, 2337-2367 (2013).
IF 3.453
15. Temesi G., Bolgár B., Arany Á., Szalai Cs., Antal P., Mátyus P.:
Early repositioning through compound set enrichment analysis: A knowledge recycling strategy.
Future Med. Chem., **6**, 563-575 (2014).
IF 3.744
16. Krajsovsky G., Tóth E., Ludányi K.:
Tandem mass spectrometric study of annelation isomers of the novel thieno[3',2':4,5]pyrido[2,3-*d*]pyridazine ring system.
Arkivoc, 158-169 (2014).
IF 1.165

17. Meleddu R., Distinto S., Corona A., Bianco G., Cannas V., Esposito F., Artese A., Alcaro S., Mátyus P., Bogdán D., Tramontano E., Maccioni E.:
(Z)-3-(2-(4-arylthiazol-2-yl)hydrazono)indolin-2-one derivatives as dual inhibitors of HIV-1 RT.
Eur. J. Med. Chem., **9**, 452-460 (2015).
IF 3.447 (2014)
18. Antus Cs., Radnai B., Dombóvári P., Fónai F., Avar P., Mátyus P., Rácz B., Sümegi B., Veres B.:
Anti-inflammatory effects of a triple-bond resveratrol analog: Structure and function relationship.
Eur. J. Pharmacol., **748**, 61-67 (2015).
IF 2.532 (2014)
19. Huleatt P.B., Khoo M.L., Chua Y.Y., Tan T.W., Liew R.S., Balogh B., Deme R., Göllöncsér F., Magyar K., Sheela D.P., Ho H.K., Sperlág B., Mátyus P., Chai C.L.L.:
Novel arylalkenylpropargylamines as neuroprotective, potent, and selective monoamine oxidase B inhibitors for the treatment of Parkinson's disease.
J. Med. Chem., **58**, 1400-1419 (2015).
IF 5.447 (2014)
20. Balogh B., Pázmány T., Mátyus P.:
Analysis of Edg-Like LPA receptor-ligand interactions.
Curr. Pharm. Des. **21**, 3533-3547 (2015).
IF 3.452 (2014)
21. Hársing L.G. Jr., Timár J., Szabó G., Udvari Sz., Nagy K.M., Markó B., Zsilla G., Czompa A., Tapolcsányi P., Kocsis Á., Mátyus P.:
Sarcosine-based glycine transporter type-1 (GlyT-1) inhibitors containing pyridazine moiety: a further search for drugs with potential to influence schizophrenia negative symptoms.
Curr. Pharm. Des., **21**, 2291-2303 (2015).
IF 3.452 (2014)
22. Baranyi M., Porceddu P.F., Göllöncsér F., Kulcsár Sz., Otrókoci L., Kittel Á., Pinna A., Frau L., Huleatt P.B., Khoo M-L., Chai C.L.L., Dunkel P., Mátyus P., Morelli M. and Sperlág B.:
Novel (Hetero)arylalkenyl propargylamine compounds are protective in toxin-induced models of Parkinson's disease.
Mol. Neurodegener., **11**, (6) 1-21 (2016).
IF: 6.563 (2014)
23. Payrits M., Sággy É., Mátyus P., Czompa A., Ludmerczki R., Deme R., Sándor Z., Helyes Zs., Szőke É.:
A novel 3-(4,5-Diphenyl-1,3-oxazol-2-yl)propanal oxime compound is a potent Transient Receptor Potential Ankyrin 1 and Vanilloid 1 (TRPA1 and V1) receptor antagonist.
Neurosci., **324**, 151-162 (2016).
IF 3.357 (2014)

24. Balogh B., Carbone A., Spanò V., Montalbano A., Barraja P., Cascioferro S., Diana P., Parrino B.:
Investigation of Isoindolo[2,1-*a*]quinoxaline-6-imines as Topoisomerase I Inhibitors with Molecular Modeling Methods.
Curr. Comput.-Aided Drug Des., **13**, 208-221 (2017).
IF 1.155 (2015)
25. Horváth Á., Awt Menghis, Botz B., Borbély É., Csepregi J., Mócsai A., Czompa A., Tóth-Sarudy É., Juhász T., Zákány R., Mátyus P., Keeble J., Pintér E., Helyes Zs.:
Analgesic and anti-inflammatory effects of the novel semicarbazide-sensitive amine-oxidase inhibitor SZV-1287 in chronic arthritis models of the mouse.
Scientific Reports **7**, 39863. Doi: 10.1038/srep39863 (2017).
IF 5.228 (2015)
26. Meleddu R., Distinto S., Cirilli R., Alcaro S., Yanez M., Sanna ML., Corona A., Melis C., Bianco G., Matyus P., Cottiglia F., Maccioni E.:
Through scaffold modification to 3,5-diaryl-4,5-dihydroisoxazoles: new potent and selective inhibitors of monoamine oxidase B.
J Enzyme Inhib Med Chem., **32**, 264-270 (2017).
IF 3.428 (2015)
27. Bogdán D., Haessner R., Vágvölgyi M., Passarella D., Hunyadi A., Gáti T., Tóth G.:
Stereochemistry, and complete ¹H and ¹³C NMR signal assignment of C-20-oxime derivatives of posterone 2,3-acetonide in solution state.
Magnetic Resonance in Chemistry (2018).
28. Szabó Z-I., Deme R., Mucsi Z., Rusu A., Mare A.D., Fiser B., Toma F., Sipos E., Tóth G.:
Equilibrium, structural and antibacterial characterization of moxifloxacin-β-cyclodextrin complex.
Journal of Molecular Structure, **1166**, 228-236 (2018).
29. Nekkaa I., Palko M., Mandity I.M., Fulop F.:
Continuous-flow retro-Diels-Alder reaction: an efficient method for the preparation of pyrimidinone derivatives.
Beilstein Journal of Organic Chemistry, **14**, 318-324 (2018).
30. Nekkaa I., Bogdan D., Gati T., Beni Sz., Juhasz T., Palko M., Paragi G., Toth G.K., Fulop F., Mandity I.M.:
Flow-chemistry enabled efficient synthesis of beta-peptides: backbone topology vs. helix formation.
Chem. Comm., **55**, 3061-3064 (2019).

31. Czompa, Andrea; Pásztor, Balázs László; Sahar, Jennifer Alizadeh; Mucsi, Zoltán; Bogdán, Dóra; Ludányi, Krisztina; Varga, Zoltán; Mándity, István M.:
Scope and limitation of propylene carbonate as a sustainable solvent in the Suzuki–Miyaura reaction.
RSC Advances, **9**, 37818-37824 (2019).
32. Jakab, Géza; Bogdán, Dóra; Mazák, Károly; Deme, Ruth; Mucsi, Zoltán; Mándity, István M.; Noszál, Béla; Kállai-Szabó, Nikolett; Antal, István:
Physicochemical Profiling of Baicalin Along with the Development and Characterization of Cyclodextrin Inclusion Complexes
AAPS Pharm.Sci.Tech., **20**, Paper: 314, 12 p. (2019).
33. Nizami, Bilal; Bereczki-Szakál, Dorottya; Varró, Nikolett; el Battioui, Kamal; Nagaraj, Vignesh U; Szigyártó, Imola Cs; Mándity, István; Beke-Somfai, Tamás:
FoldamerDB: a database of peptidic foldamers.
Nucleic Acids Research, **48**, D1122-D1128 (2020).
34. Ludmerczki, Robert; Malfatti, Luca; Stagi, Luigi; Meloni, Manuela; Carbonaro, Carlo Maria; Casula, Maria Francesca; Bogdán, Dóra; Mura, Stefania; Mándity, István M.; Innocenzi, Plinio:
Polymerization-Driven Photoluminescence in Alkanolamine-Based C-Dots.
Chemistry-A European Journal, **27**, 2543-2550. (2021).
35. Balogh, Balázs; Ivánczi, Márton; Nizami, Bilal; Beke-Somfai, Tamás; Mándity, István M:
ConjuPepDB: a database of peptide–drug conjugates.
Nucleic Acids Research **49**, D1 D1102-D1112 (2021).
36. Batta, Gyula; Kárpáti, Levente; Henrique, Gabriela Fulaneto; Tóth, Gabriella; Tarapcsák, Szabolcs; Kovács, Tamás; Zákány, Florina; Mándity, István M.; Nagy, Peter:
Statin-boosted cellular uptake and endosomal escape of penetratin due to reduced membrane dipole potential.
British Journal of Pharmacology In press Paper: bph.15509 (2021).

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