CURRENT LIST OF TOPICS IN 2017, DOCTORAL SCHOOL OF CHEMISTRY

supervisor	*supervisor's e-mail address*	*topic*	*description*	*place of research*	*knowledge of English required*	*professional requirements*
Attila G. Császár	csaszar@chem.elte.hu	The fourth age of quantum chemistry: molecules in motion	In the fourth age of quantum chemistry nuclear motion techniques are becoming competitive with experiment in accurately predicting and understanding the motions of the nuclei within molecules. Nevertheless, further development of the existing algorithms and computer codes is essential to make further progress in this field of quantum chemical research.	Eötvös Loránd University, Institute of Chemistry	at least B2 level	
Attila G. Császár	csaszar@chem.elte.hu	Small molecules as complex systems	Techniques of network (graph) theory are highly advantageous to understand high-resolution molecular spectra. This research aims to further employ network theory, in particular the theory of spectroscopic networks, to the study of complex high-resolution molecular spectra.	Eötvös Loránd University, Institute of Chemistry	at least B2 level	
Attila G. Császár	csaszar@chem.elte.hu	Exotic chemical phenomena: tunneling and resonances	Quantum tunneling and molecular resonance states are becoming increasingly popular topics for challenging experimental studies. The theory necessary for the detailed understanding of these "exotic" phenomena is under development in the group but requires further algorithmic and programming efforts to make the techniques truly applicable to molecules of arbitrary size and complexity. The efficient treatment of resonances requires the further development of non-Hermitian quantum chemistry.	Eötvös Loránd University, Institute of Chemistry	at least B2 level	
Attila G. Császár	csaszar@chem.elte.hu	Quantum molecular dynamics	Nuclear motion algorithms and codes developed in our group are to be modified to allow the quantum chemical characterization of uni- and especially bimolecular reactions.	Eötvös Loránd University, Institute of Chemistry	at least B2 level	
Tamás Turányi	turanyi@chem.elte.hu	Reaction kinetics of nitrogen compounds in combustion systems	NO emitted to the atmosphere causes photochemical smog and acid rain, while N2O is a greenhouse gas, which is 300 times more effective than CO2. The most significant source of NO in the atmosphere is combustion, mainly furnaces and internal combustion engines. A great part of N2O is also produced during combustion. The aim of the research project is the elaboration of a detailed chemical kinetic model that quantitatively describes the formation of NO and N2O in combustion systems from the nitrogen content of the air and the fuel, and also the conversion of the nitrogen compounds formed back to N2.	Chemical Kinetics Laboratory, Institute of Chemistry, ELTE H-1117 Budapest Pázmány Péter sétány 1/A Hungary	at least B2 level	
Tamás Turányi	turanyi@chem.elte.hu	Modelling of the combustion of butanol	Butanol and ABE (mixture of acetone, butanol and ethanol) are new generation biofuels. The task is the development of a new detailed reaction mechanism for the description of the combustion of butanol and ABE; testing this mechanism against literature experimental data and reduction of the mechanism for CFD calculations.	Chemical Kinetics Laboratory, Institute of Chemistry, ELTE H-1117 Budapest Pázmány Péter sétány 1/A Hungary	at least B2 level	

Zoltán Bánóczi	banoczi@elte.hu	Synthesis and functional characterization of peptide-conjugate containing antitumor drug	In the developed bioconjugates, antitumor drugs will be attached to cell-penetrating peptides as carrier and targeting moiety. Different bond type will be used between the peptides in order to study the effect of the conjugation mode. The in vitro antitumor activity of conjugates will be measured by MTT-assay on several sensitive and resistant human cancer cell lines. The antitumor effect of prominent conjugates will be also studied in vivo.	Department of Organic Chemistry, Institute of Chemistry, ELTE	at least B2 level	
Zoltán Bánóczi	banoczi@elte.hu	Synthesis and functional characterization of new cell-penetrating peptides	To improve the cellular-uptake of cell-penetrating peptides, new peptide derivatives will be synthesized. Their cellular-uptake profile, intracellular distribution will be studied.	Department of Organic Chemistry, Institute of Chemistry, ELTE	at least B2 level	
Zsuzsanna Eke	eke.zsuzsanna@wirec.eu	Migration of additives from plastics	Additives are often used in the plastics industry to protect the material both during and after the manufacturing process. As these compounds are likely to migrate into foodstuff, the substances used as additives in the production of food contact materials are highly regulated by the European Union. In regulation 10/2011/EC specific migration limit (SML) values were set and obligatory migration studies were enacted. Despite the existence of the regulation a lot of questions arise concerning the migration and the migration studies. For example: Food simulants were introduced and assigned to different types of food in order to simplify the migration studies. But do they mimic closly enough the corresponding food types? How can migration studies of the plastics be futrther simplified? What about the degradition products of the additives?	ELTE Institute of Chemistry, Joint Research and Training Laboratory on Separation Techniques (EKOL)	at least B2 level	Experience in analytical chemistry, basic knowledge of chromatographic techniques
László Bencs	bencs.laszlo@wigner.mta.hu	Studies on high resolution atomic absorption spectrometric methods for the direct solid analysis of environmental samples and advanced nano-materials	This research focuses on studying the possibilities for the direct solid sampling analysis of the composition of small (microgram) amounts of environmental matrices (e.g., soils, aerosols) and advanced nanomaterials (e.g., doped nano-SiC) by high-resolution continuum source atomic absorption spectrometry (HR-CS-AAS). The purpose of the work is to develop modern solid sampling analytical methods for the concerned matrices in HR-CS-AAS, studying spectral and non-spectral interferences, and to suggest methods for their reduction or elimination. A further research task could be the systematic investigation on the vaporization and atomization processes of the matrix constituents in spectrochemical sources (e.g., graphite/quartz furnaces), and elaboration of accurate calibration procedures for the quantitation of trace components in various samples as noted above.	Institute for Solid State Physics and Optics, Wigner Research Centre for Physics of the Hungarian Academy of Sciences, H-1121 Budapest, Konkoly-Thege Miklós út 29-33.	at least B2 level	Skills in instrumental techniques and in handling/preparing micro-samples are a certain advantage.

László Bencs	bencs.laszlo@wigner.mta.hu	Development and study of an atmospheric glow discharge for the trapping and quantitation of the metal content of ambient aerosols	In this research, we plan to develop and study a monitor-type analyzer system for the determination of the metal content of atmospheric aerosols, implying field conditions too. This analytical arrangement is a combination of an electrostatic precipitator (to be used for the trapping of aerosol particles) and a direct current glow discharge (to be used for the vaporization of the trapped aerosol samples by cathode sputtering, followed by atomization, excitation and emission detection). The main aim of this work is to assembly the "breadboard" of the measurement system and to study its fundamental features and to optimize the operating conditions (e.g., aerosol sampling rate, trapping efficiency, plasma parameters), which are the most favourable for the fast monitoring of the metal composition of atmospheric aerosols.	Institute for Solid State Physics and Optics, Wigner Research Centre for Physics of the Hungarian Academy of Sciences, H-1121 Budapest, Konkoly-Thege Miklós út 29-33.	at least B2 level	
Gitta Schlosser	sch@chem.elte.hu	Discovery of protein citrullination using mass spectrometry	Posttranslational modifications determine the structure, function and activity of proteins. Citrullination or deimination is an irreversible posttranslational modification of proteins, in which arginine (Arg) residues are converted to citrulline (Cit) residues in an enzyme-catalyzed reaction. Citrullinated proteins can be detected in elevated levels in certain autoimmune and inflammatory diseases, neurodegenerative diseases and in cancer. The aim of the proposed research work is the exploration of the specificity and kinetics of the enzymatic conversion to have detailed information about the physico-chemical parameters regulating the formation of deiminated residues in biopolymers. Experimental strategy is based on oligopeptides, which will be synthesized using solid-phase peptide synthesis. Peptides will be analyzed in a novel HPLC-MS(/MS)-based experimental workflow.	Eötvös Loránd University, Institute of Chemistry	at least B2 level	Experience in analytical chemistry, or in organic chemistry
Gábor Magyarfalvi	gmagyarf@chem.elte.hu	Magnetic properties of molecules	The aim of the primarily theoretical and computational research project is to work out calculation methods for novel molecular properties. Calculations and characterization of properties associated with molecular behaviour in magnetic fields, such as current densities are intended to assist in interpretation of spectroscopic (NMR, VCD, ROA) parameters.	ELTE Institute of Chemistry	at least B2 level	Familiarity with basic theoretical and computational tools of quantum chemistry
Zoltán Novák	novakz@elte.hu	Study of transition metal catalyzed reactions	The goal of the project is the study and development of novel transition metal catalyzed reactions, including cross-coupling, C-H activation, photoredox catalysis and other synthetic transformations. The actual topics of project will be finalyzed after discussion with the applicants.	Eötvös Loránd University, Institute of Chemistry	At least B2 level	Organic chemistry (theory and practice), reaction mechanisms, organometallic chemistry, catalysis, chemical analysis (nmr, gc, MS, TLC). Laboratory skills (reactions in inert atmosphere, column chromatography, distillation); user level computer skills
Zoltán Homonnay	homonnay@caesar.elte.hu	Mössbauer study of iron chelates in frozen aqueous solutions	The scheduled research involves Mössbauer studies of various iron chalates in frozen solutions. These compounds (e.g., iron complexes of EDTA, CDTA, EDDA) have both biological and environmental relevance. However, their Mössbauer study is hindered by the strong concentration and local structure dependence of the paramagnetic spin relaxation creating great challange to the experimentalist when evaluating the spectra (non-Lorentzian curves). The main goal of the research is to explore how the rate oif this relaxation depends on the choice of the chelating agent, pH of the solution and the concentration of the iron species. This is a precondition for the correct identification of iron species in the solution.	Laboratory of Nuclear Chemistry (1117 Budapest Pázmány Péter sétány 1/A)	at least B2 level	BSC level chemistry and some background in Nuclear Chemistry or Nuclear Physics

András Perczel	perczel@chem.elte.hu	BioNMR Spectroscopy of polypeptides and proteins	Research topics focusing on structure elucidation, dynamic properties, intermolecular interaction, ligand and small molecule interaction screening, MM and QM calculated NMR properties, etc.	ELTE Institute of Chemistry	at least B2 level	basic knowledge of spectroscopy (NMR, MS), organic chemistry, biochemsitry, structural chemsitry
András Perczel	perczel@chem.elte.hu	Amyloid and self aggregating polypeptides and proteins	research topics focusing on self associating petides related to type II *diabetes mellitus* (e.g. Exenatid, GLP-1), gel forming peptide and carbohydrate derivatives, cellular essays, structure function relationship, spectroscopic (NMR, ECD, VCD, FT-IR) characterisation of folding, unfolding and amyloid formation, etc.	ELTE Institute of Chemistry	at least B2 level	basic knowledge of spectroscopy (NMR, MS), organic chemistry, biochemsitry, structural chemsitry
György G. Ferenczy	ferenczy.gyorgy@ttk.mta.hu	Computational Chemistry in Drug Discovery	Development and application of computational methods able to support drug discovery projects. The methods include classical and quantum mechanical molecular modelling tools, quantitative structure-activity relationship studies, ligand and protein structure based virtual screening, molecular dynamics and data mining. Analysis and prediction of physico-chemical properties and ligand-protein interactions of drug candidates in order to optimize these features and to develop potential drug candidates.	Research Centre for Natural Sciences	at least B2 level	
László Héja	heja.laszlo@ttk.mta.hu	Identification of new drug targets by revealing glia-neuron communication pathways	The objective of the PhD student will be to identify novel drug targets for the treatment of pharmacoresistant epilepsy primarily by revealing and characterization of glia-neuron communication pathways. The potential drug targets will be investigated by: 1) simultaneous monitoring of neuronal and glial activity in wild-type and transgenic rats (expressing fluorescent Ca2+ sensitive reporter proteins) in vitro and in vivo using fluorescent two-photon imaging and electrophysiology; 2) pharmacological validation of the identified drug targets in in vitro epilepsy models; 3) development of novel methods for targeted investigation of the potential drug target mechanisms. The tasks of the PhD student include the design and execution of the experiments, tracking of the literature and publication of the results.	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	fluent English	- MSc degree in the field of natural or life sciences - Proof of English proficiency - Due to the requirements of the scholarship the applicant should be below 30 years
Péter Kele	kele.peter@ttk.mta.hu	Design and synthesis of upconverting nanomaterials enabling targeted, NIR light induced drug release	Photosensitive materials have attracted interest for drug delivery, super resolution microscopy, photopatterning or information storage. Most photosensitive materials are sensitive to UV light, however, the use of UV irradiation is problematic. In biomedical applications UV light cannot penetrate deeply into tissues and may damage biomatter. Contrary to UV light, near-infrared (NIR) irradiation has significant advantages such as remarkable minimization of photo-damage to biological specimens, maximization of the penetration depth of the excitation light in biological tissue, and an excellent signal-to-noise ratio along with improved detection sensitivity due to the lack of auto-fluorescence from biological materials. Lanthanide-doped nanocrystallyne systems (UCNPs) enable NIR induced anti-Stokes luminescence that can be excited with inexpensive, low-power laser diodes and induce emission of visible light. We aim at conducting a systematic study of the different elements of constructs composed of UCNPs decorated with photolabile-	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	fluent English	- MSc degree in the field of natural or life sciences - Proof of English proficiency Due to the requirements of the scholarship the applicant should be below 30 years

			linker anchored drug molecules and homing elements enabling targeted delivery. Such constructs can achieve specific delivery of selected chemotherapeutic agents to targeted cells, where drug release can be effected by NIR light in a controllable manner. Throughout the project we shall study the elements of these constructs: (a) synthesis and evaluation of photolabile linkers, (b) screen for the most efficient UCNP-linker conjugates (c) orthogonal functionalization of UCNPs in order to install photolabile linker-drug conjugates and homing vectors onto their surface and as time allows.			
István Szalai	szalai.istvan@chem.elte.hu	Pattern formation in reaction diffusion-systems	Far from thermodynamic equilibrium, temporal or spatial structures can spontaneously emerge in systems involving nonlinear cooperative processes. Chemical "dissipative structures" are one of the main topics of the nonlinear science. A large variety of spatio-temporal behaviors like excitability waves, standing Turing and front patterns and chemomechanical structures have been observed in the past decades. These patterning instabilities have been demonstrated in only a handful of reactions, however tens of reaction families counting hundreds of variants are known to produce temporal self-organisations (e.g. bistability and oscillations). We anticipate, that most of these reactions can be used to develop spatio-temporal patterns under proper conditions (e.g. in appropriately designed open-spatial-reactors). The main goal of the research work is to design and control of pattern and shape formation in nonlinear chemical systems. We shall study kinetic or diffusion-driven instabilities in bistable/oscillatory reactions. Beyond that, we shall use of these reaction-diffusion systems to design autonomous soft chemomechanical systems (e.g by coupling a pH-autoactivated reactions with a polyelectrolyte gel). Soft chemomechanical systems, which transform chemical energy to mechanical work, are ubiquitous in living systems, they play a key role in muscular contraction, cell division, cellular traffic etc. The cross-coupling of the size change of the gel with the autoactivated reactions that produces spatial bistability uncovers new sources of dissipative structures. Beside more theoretical considerations, the latter research may lead to results of potential relevance in the biological self-organization.	Institute of Chemistry, Eötvös University	fluent English	
Péter Surján	surjan@chem.elte.hu	Elelctron correlation in molecular systems	Description of electron correlation, development and programming of new computational techniques, algortithms and methods	Laboratory of Theoretical Chemistry, ELTE TTK	basic communication, ability to read scientific papers, ability to lecture	
Éva Kiss	kisseva@chem.elte.hu	Nanostructural drug delivery systems	Preparation, characterization of various drug constructions and colloidal polymeric particles for enhanced drug delivery and targeting. Influence of surface properties on the interaction with membrane lipids.	Laboratory of Interfaces and Nanostructures Institute of Chemsitry	at least B2 level	
Éva Kiss	kisseva@chem.elte.hu	Development of biocompatible drug delivery systems	Synthesis and characterization of biodegradable polymeric nanoparticles	ELTE Institute of Chemsitry	at least B2 level	

Éva Kiss	kisseva@chem.elte.hu	Molecular interactions in cell membrane model systems	Experimental investigation of penetration and transport properties of bioactive components	ELTE Institute of Chemsitry	at least B2 level	
László Túri	turi@chem.elte.hu	Radiolysis of water: ab initio molecular dynamics simulations	The aim of the present project is to examine elementary chemical reactions taking place in bulk liquids or in clusters using ab initio molecular dynamics simulation techniques. The reactions include those following the radiolysis of water and involve reactive radicals and ionic species.	ELTE, Institute of Chemistry	at least B2	Computer programming experience
László Túri	turi@chem.elte.hu	The development of a new mixed quantum-classical molecular dynamics simulation method.	The aim of the project is to develop a novel molecular dynamics simulation method that consistently treats the quantum mechanically described, smaller, but chemically more relevant part of the examined system and its classically treated environment. One of the addressed questions is the implementation of multiple time- and size scale algorithms in the formalism.	ELTE, Institute of Chemistry	at least B2	Computer programming experience
László Túri	turi@chem.elte.hu	The application of quantum-classical molecular dynamics simulation methods for biologically relevant systems	The aim of the project is to apply mixed quantum-classical molecular dynamics simulation techniques to models that mimick biologically important systems. The research includes characterization of basic molecular biomolecular interactions and simulation of such processes as electron- and proton transfer.	ELTE, Institute of Chemistry	at least B2	Computer programming experience
Edit Mátyus	matyus@chem.elte.hu	Theoretical developments for precision spectroscopy of small molecules	We develop theoretical and computational methods to obtain exceedingly accurate properties of small molecules, which go much beyond the Born-Oppenheimer and non-relativistic approximations commonly introduced in quantum chemistry. The results will challenge precision spectroscopy measurements and contribute to the testing of fundamental physical constants.	ELTE, Institute of Chemistry	at least B2	
Edit Mátyus	matyus@chem.elte.hu	Development of path-integral methods for the quantum mechanical description of complex molecular systems	For certain properties of molecular systems which are difficult (or impossible) to compute by means of a direct basis-set approach, the path-integral formalism of quantum mechanics can offer an alternative, interesting to explore. Our aim is to develop efficient still accurate alternative methods for certain thermodynamic or even spectroscopic properties of molecular systems.	ELTE, Institute of Chemistry	at least B2	
Edit Mátyus	matyus@chem.elte.hu	Computational study of spectroscopic and thermodynamic properties of molecular complexes	Molecular complexes are the simplest chemical objects to study molecular interactions and to test the potential energy functions which describe these interactions by measuring and computing their high-resolution spectra. Our aim is to compute spectroscopic and thermodynamic properties of smaller complexes by means of variational and path-integral methods. This project requires further development of these methods, derivation of simple relationships using group theoretical considerations, development of analysis tools for floppy, delocalized systems, and performing large-scale computations.	ELTE, Institute of Chemistry	at least B2	

Attila Bóta	bota.attila@ttk.mta.hu	Structural study of diluted biological macromolecules	Size and shape of chosen protein/or their associates will be determined in their diluted states in the convenient physical-chemical milieu by means of small angle X-ray scattering. Other methods (FT-IR spectroscopy, calorimetry, light scattering) will also be applied to obtain complex structural information.	Research Centre for Natural Sciences Hungarian Academy of Sciences, Institute of Material and Environmental Chemistry, Biological Nanochemistry Research Group	at least B2	
András Perczel	perczel@chem.elte.hu	Conformational analysis of peptides and proteins	Comprehensive knowledge on secondary and tertiary structure elucidation of polypeptides and proteins is a general requirement for understanding structural chemistry and biology. This special course is dedicated to knos more about NMR, X-ray, ECD, IR and computational aspects of this filed. No need to know much about these biophysical technics, just sign up if you want to learn more about it.	ELTE, Institute of Chemistry	at least B2	
András Perczel	perczel@chem.elte.hu	Pulse sequences in bioNMR spectroscopy	Modern bioNMR spectroscopy comprises a set of manufacturer provided and a set of home made pulse sequences. Understanding NMR pulse sequences is important for understanding NMR and for selecting the proper NMR experiment. This lecture explains basic pulse sequences from screech based on Product Operator Formalism. No need to know much about NMR, just sign up if you want to learn more about it.	ELTE, Institute of Chemistry	at least B2	No need to know much about NMR, just sign up if you want to learn more about it.
Győző Láng	langgyg@chem.elte.hu	Investigation of the kinetics of electrochemical processes by using multielectrode systems		ELTE, Institute of Chemistry	at least B2	
Győző Láng	langgyg@chem.elte.hu	Invstigation of the electrochemical stability of implant materials		ELTE, Institute of Chemistry	at least B2	
Győző Láng	langgyg@chem.elte.hu	Investigation of the electrochemical stability of conducting polymer films and thin metal layers		ELTE, Institute of Chemistry	at least B2	
Imola Csilla Szigyártó	szigyarto.imola.csilla@ttk.mta.hu	Extracellular vesicles: isolation, characterization and applicability as theranostics	Extracellular vesicles (EVs) are biological nanoparticles released by cells into the extracellular space and contain biomolecules (such as DNA, RNA, proteins, phospholipids) that may be characteristic to their cell of origin. They are important mediators of intracellular communication and are involved in many physiological conditions, so they may provide a wealth of information for early diagnosis and treatment of various diseases. With the growing interest in EVs, various isolation techniques have been developed. The efficiency of isolation using density- and size-based isolation methods will be compared. Different bio-physical characterization methods will be used including electron microscopy, dynamic light scattering, protein assays, and spectroscopy methods. In addition, vesicles interactions with drug molecules will be investigated.	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	at least B2	goog synthetic skill, wide interest in structure investigation/separation methods

Zoltán Németh	nemeth.z@wigner.mta.hu	Local and remote interactions in photoswitchable transition metal compounds	Photoswitchable spin crossover molecules have been in the forefront of molecular magnetism research for decades. The excited state of one of the basic tridentate polypyridil Fe(II) complex, [Fe(terpy)2]2+, can be elongated with more than 10 orders of magnitudes in special environments and circumstances and can be made to be metastable. The PhD work will aim to investigate the intra and intermolecular roots of this phenomena combining laboratory-, synchrotron- and XFEL based X-ray spectroscopies, Mössbauer and optical spectroscopies, as well as quantum chemical calculations. We plan to redesign the tridentate ligand as well as to modify the matrix towards higher efficiency and higher working temperatures, as this is the prerequisite of any application. In order to achieve the goals of the proposed research, the PhD student will extend our novel, unique experimental setup to access high resolution X-ray absorption and emission spectroscopies using a laboratory source, which can complement, even replace in some cases the heavily loaded and thus only occasionally accessible synchrotrons. Low intensity X-ray sources and inefficient spectrometers prevented high resolution X-ray spectroscopies to spread in local laboratories, thus synchrotrons became to be known inevitable to perform such measurements. However, the developments in both analyzers and detector technology in the recent years gave the opportunity to build an efficient high resolution tabletop spectrometer. The PhD student will also participate in experiments at international facilities (synchrotrons and XFELs), optical and Mössbauer spectroscopic studies as well as in theoretical modelling.	HAS Wigner RCP	at least B2	The ideal candidate has an MSc in chemistry or related fields, is familiar with spectroscopic methods, fluent in English, and possess basic programming skills
Gergő Gyulai	ggyulai@chem.elte.hu	Functional polymer nanogels	Colloidal carrier systems are getting ever wider role in targeted drug therapies. The aim of the research is the development and physicochemical characterization of a hydrogel based core-shell structured drug carrier platform.	ELTE Institute of Chemistry	at least B2	
Zoltán Varga	varga.zoltan@ttk.mta.hu	Nanoparticles for medical biology	The medical application of nanoparticles ranges from their utilization in therapy and diagnostics, which includes the targeted delivery of various drugs as well as their use in molecular diagnostics. The current topic relates to the application of gold nanoparticles in the latter field. The goal of the research work is the biocompatible surface modification and functionalization of gold nanoparticles with peptides and oligonucleotides and their in vitro testing for the diagnosis of various cancers by molecular imaging and genetic mutations. The planned work includes acquiring the necessary skills in preparative nanochemistry as well as in the measurement methods (DLS, TEM, FTIR, SAXS) for the thorough physico-chemical characterization of the nanoparticles. Additionally, the in vitro testing of the functionalized nanoparticles in cell cultures is also part of the PhD project.	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	fluent	Basic knowledge in colloid chemsitry and biochemistry, good communication skills, both oral and written english, ability to work in a group, as well as independently

Zoltán Varga	varga.zoltan@ttk.mta.hu	Detection, isolation and characterization of extracellular vesicles	Extracellular vesicles (EVs) are key players of the intercellular communication, but they received attention only in recent years. EVs are phospholipid bilayer enclosed structures that can carry proteins and nucleic acids, but they are also capable of serving the secretion of toxic molecules. The idea of using EVs as biomarkers of various diseases has developed in parallel with the recognition of their physiological role. Due to the functional and morphological heterogeneity of EVs, their separation from complex body fluids, and the detection of disease specific EVs face many challenges. Novel size exclusion and affinity chromatography can be utilized to separate the EVs with diagnostic potential, which supplemented with thorough biochemical and structural characterization can serve the identification of EV-based disease-markers. The task of the PhD student within this research topic is the isolation of EVs from various body fluids with beyond-state-of-the-art affinity chromatography and the biochemical and physico-chemical description of the vesicle samples with analytical and structural characterization methods (including ATR-FTIR and SAXS).	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	fluent	Basic knowledge in colloid chemsitry and biochemistry, good communication skills, both oral and written english, ability to work in a group, as well as independently
Attila Demeter	demeter.attila@ttk.mta.hu	Effect of the solvent properties on the photochemical and photophysical processes.	Photophysical and photochemical examinations on the influence of the solvent polarity and hydrogen bond formation ability using selected organic model compounds. Contribution to develop an economical water purification procedure using photochemical oxidation of organic contaminants with immobilized TiO2.	Research Centre for Natural Sciences of Hungarian Academy of Sciences	at least B2	MsC chemistry
Kata Horváti	khorvati@gmail.com	Synthesis and biological evaluation of peptide-based vaccine candidates	Synthesis, analytical characterization, in vitro and in vivo biological evaluation of immunlogically active peptide conjugates	MTA-ELTE Research Group of Peptide Chemistry	intermediate level B2	laboratory practice in organic chemistry
Kata Horváti	khorvati@gmail.com	Peptide-based conjugates against tuberculosis	Peptide conjugates of molecules active against Mycobacterium tuberculosis - synthesis, analytical characterization, in vitro and in vivo biological evaluation.	MTA-ELTE Research Group of Peptide Chemistry	intermediate level B2	laboratory practice in organic chemistry
Zsuzsanna Novákné Dr. Czégény and Emma Pekkerné Dr Jakab	czegeny.zsuzsanna@ttk.mta.hu	Thermal decomposition of lignocellulosic biomass materials	The extensive use of biomass as a renewable energy source could reduce the dependence on fossil fuels, along with the low carbon dioxide emissions into the atmosphere, leading to less greenhouse effect. Broadening the scientific information about the thermal decomposition processes taking place under recycling of lignocellulosic biomass materials via thermal conversion could help improve the quality of the products and the feasibility of the applied recycling method.	Research Centre for Natural Sciences, Hungary, 1117 Budapest, Magyar tudósok körútja 2.	at least B2	