

# KOLOKVIUM 2020

**Ústav makromolekulární  
chemie AV ČR, v. v. i.**

Heyrovského náměstí 2  
162 06 Praha 6

**3. 2. – 6. 2. 2020**

# 29. KOLOKVIUM



# K O L O K V I U M

Kolokvia jsou od roku 1992 výroční interní konferencí Ústavu makromolekulární chemie AV ČR, v. v. i.

Reflektují celosvětové trendy základního a aplikovaného výzkumu v oboru makromolekulární chemie a hlavní směry výzkumu ÚMCH AV ČR.

Nabízejí zaměstnancům ústavu a dalším hostům prostor pro odbornou diskuzi nad aktuálními výsledky řešených výzkumných projektů s možností rozvíjet vzájemnou spolupráci.

Součástí Kolokvií jsou také přednášky pracovníků ústavu oceněných v uplynulém roce - Zuzany Morávkové, Lenky Loukotové, Karla Duška a Pavla Kratochvíla.

Závěrečná sekce Kolokvia "Jak se dělá věda jinde" bude tentokrát věnována Evropské polymerní federaci zejména v souvislosti se jmenováním Dr. Jiřího Kotka jejím současným předsedou.

**Těšíme se na Vás na našem 29. Kolokviu**

# PROGRAM

## Pondělí 3. 2.

9:00 **Jiří Kotek, Petr Šálek**  
Zahájení

9:10

9:10 **A1 Miroslava Lukešová**  
Electron paramagnetic resonance spectroscopy

9:35 **A2 Nadiia Velychkivska**  
Physico-chemical study of stimuli-responsive supramolecular systems

10:00 **A3 Josef Jůza**  
Kompatibilizace polymerních směsí blokovými kopolymery

10:25 **A4 Lucie Woldřichová**  
New types of phosphorus-containing polymers: from synthesis to application

Petr Šálek

10:50 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

11:10 **A5 Zulfiya Černochová**  
Thermodynamics of the multi-stage self-assembly of pH-sensitive gradient copolymers in aqueous solutions

11:35 **A6 Vladimír Raus**  
Well-defined linear and grafted poly(2-isopropenyl-2-oxazoline)s prepared via copper-mediated RDRP methods

12:00 **A7 Konstantin Milakin**  
Conducting cryogels based on polyaniline and its derivatives

Miroslava Lukešová

12:25 **PŘESTÁVKA** Oběd

13:30

13:30 **A8 Vladimír Proks**  
Xeno-free povrchy pro kultivace lidských embryonálních kmenových buněk - 1. část

13:55 **A9 Josef Jaroš**  
Xeno-free povrchy pro kultivace lidských embryonálních kmenových buněk - 2. část

14:20 **A10 Veronika Gajdošová**  
Micromechanical properties of polymers: detailed interpretation with the help of SEM and 3D-LM microscopy

14:45 **A11 Jakub Širc**  
Hydrogel implants for retinoblastoma therapy

Petr Chytil



# PROGRAM

## Úterý 4. 2.

9:00

9:00 **A12 Zdeněk Starý**

Capillary rheometry - features and examples from applied research

9:25 **A13 Suzana Natourova**

High-performance protective coatings based on polyurea: Study of depth-dependent film formation processes

9:50 **A14 Kristýna Kolouchová**

Samospořádané fluorované polymerní systémy na bázi poly[(*N*- 2,2-difluorethyl) akrylamidu] jako diagnostické a theranostické kontrastní látky pro 19F MRI

10:15 **A15 Jiří Czernek**

The NMR crystallography in the pursuit of a solid-phase structure of *N*-formyl-MLF-OH tripeptide

Josef Jůza

10:40 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

11:00 **A16 David Babuka**

Investigation of the internal structure of thermoresponsive diblock PMeOx-b-PDFEA copolymer nanoparticles

11:25 **A17 Sabina Abbrent Nováková**

Following copolymer chain formation of 2-oxazolines by *in-situ* <sup>1</sup>H-NMR spectroscopy

11:50 **A18 Małgorzata Świątek**

Phenolic compound-modified iron oxide nanoparticles. Are they effective tools to suppress oxidative stress?

Zdeněk Starý

12:15 **PŘESTÁVKA** Oběd

13:30

13:30 **A19 Jana Kousalová**

Polymery pro inhibici MMP

13:55 **A20 Jiří Trousil**

Beating intracellular bugs using nanobead-based interventions

14:30 **A21 Dana Kubies**

Alginate hydrogel beads as a platform for delivery of proteins

15:00 **A22 Richard Hoogenboom (speciální host)  
Ghent University, Belgium**

Poly(2-isopropenyl-2-oxazoline) as versatile platform for responsive polymers and supramolecular hydrogels

Vladimír Proks

# P R O G R A M

## Středa 5. 2.

9:00

9:00 **A23 Marina Tavares**

Tumor-targeted polymer-based theranostics for photodynamic therapy

9:25 **A24 Olga Janoušková**

"Advanced" *in vitro* methods for evaluation of biological characteristics of polymer therapeutics and other nanomaterials

9:50 **A25 Elena Tomšík**

Completely soluble PEDOT: self-polymerization of EDOT

10:15 **A26 Miloš Netopilík**

Retention mechanism of branched macromolecules in size exclusion chromatography

Jakub Širc

10:40 **PŘESTÁVKA** Občerstvení a diskuze u posterů v klubu B a C

11:00 **A27 Věra Cimrová**

Donor-acceptor copolymers with interesting properties for photonics

11:25 **A28 Miroslav Menšík**

Field-effect transistors based on nano-brushed systems

11:50 **A29 Markéta Bláhová**

Synthesis of PCL-graft-pHPMA copolymers for efficient tumor drug delivery

12:15 **A30 Michal Babič**

Polymerní kontrastní látky pro fotoakustické zobrazování

Elena Tomšík

12:40 **PŘESTÁVKA** Oběd

14:00

14:00 **A31 Vladimír Sincari**

Reactive oxygen species (ROS)-responsive polymersomes with site-specific chemotherapeutic delivery into ROS-rich tumor *in vivo*

14:25 **A32 Bartosz Paruzel**

Optimization of multilayer structures for organic electronics

14:50 **A33 Júlia Kudláčová**

Polymeric nanoprobe for advanced flow cytometry

15:15 **A34 Miroslav Šlouf**

Cryo-SEM and cryo-TEM microscopy: visualization of polymer hydrogels and nanoparticles

Věra Cimrová



# PROGRAM

## Čtvrtek 6. 2.

10:00	<b>Přednášky oceněných pracovníků</b>	
10:00	<b>B1 Zuzana Morávková</b> Raman spectroscopy of polyaniline	Petr Šálek
10:30	<b>B2 Lenka Loukotová</b> Novel polysaccharide-based polymers for immunoradiotherapy	
11:00	<b>B3 Karel Dušek</b> Volume phase transition in gels: its discovery and development	
11:30	<b>B4 Pavel Kratochvíl</b> Příspěvek Jiřího Podešvy "Pavel Kratochvíl a jeho vědecký přínos"	
12:00	<b>PŘESTÁVKA</b> Oběd	
14:00	<b>Předání ceny za studentskou přednášku</b>	
14:15	<b>Jak se dělá věda jinde</b>	
14:15	<b>Jiří Kotek</b> Představení Evropské polymerní federace	Jiří Kotek / Petr Šálek
14:30	<b>C1 Daniel Grande</b> <b>(ICMPE, Université Paris-Est Créteil, France)</b> Porous materials with controlled pore morphology and functionality derived from functional polymers: <i>From design to application</i>	
15:00	<b>C2 Katja Loos</b> <b>(University of Groningen, The Netherlands)</b> Enzymatic polymerizations – making polymer synthesis more sustainable	
15:30	<b>C3 Jean-François Gerard</b> <b>(INSA Lyon, France)</b> Combining metal-oxo clusters and ionic liquids for modifying polymer networks	
16:00	<b>Zakončení kolokvia a ústavní večírek</b>	

# Seznam posterových prezentací

- D1 Sonia Bujok**  
Roles of LDH-ionic liquids in PCL nanocomposites preparation: *in-situ* polymerization vs. melt-intercalation
- D2 Jiří Czernek**  
On the 91-Zr chemical shielding scale
- D3 Veronika Gajdošová**  
Controlled tuning of AgNPs by aged THF: spectrophotometric and microscopic study
- D4 Iryna Ivanko**  
Hydrophobic poly(3,4-ethylenedioxythiophene)-based solid contact like ion-electron transducer for sensing application
- D5 Alessandro Jäger**  
Three-dimensional hydrodynamic flow focusing microfluidic for the production of monodisperse polymer nanoparticles
- D6 Ilya Kotelnikov**  
Preparation of substrates for cell cultivation
- D7 Johanka Kučerová**  
Fibrin meshes releasing platelet lysate components for the treatment of diabetic wounds
- D8 Miroslava Lukešová**  
EPR study of polymer protective coatings for depleted uranium components
- D9 Eliška Mázl Chánová**  
Synergic effect of composite polyester nanofibers with carbon-based nanofillers and mechanical stimulation on stem cells' osteo-differentiation
- D10 Islam Minisy**  
Highly electrically conductive 1D-polypyrrole prepared in the presence of safranin
- D11 Mykhailo Nahorniak**  
Surface-engineered lanthanide nanoparticles for biomedicine
- D12 Martina Nevoralová**  
Rheological characterization of starch-based biodegradable polymer blends
- D13 Diana Oleshchuk**  
Effect of surfactants on biocompatible and biodegradable poly( $N^5$ -2-hydroxypropyl-L-glutamine)-based nanogel preparation and *in vivo* imaging of nanogel biodistribution
- D14 Oleksandr Shapoval**  
Design of nanosized rare-earth fluorides for MRI and up/downconversion luminescence
- D15 Hana Studenovská**  
Comparison of conventional culturing membranes with nanofibrous membranes for retinal tissue engineering



Vzdělávací a informační středisko  
**ÚMCH AV ČR, v. v. i.**, pořádá ve dnech  
3. – 6. února 2020 vnitroustavní konferenci  
**KOLOKVIUM 2020**

**Setkání se uskuteční v přednáškovém sále A a v klubu B  
v budově Ústavu makromolekulární chemie AV ČR, v. v. i.,  
Heyrovského náměstí 2, Praha 6-Petřiny.**

**Významné přednášky:**

**Přednášky oceněných pracovníků ÚMCH v roce 2019**

**čtvrtek 6. 2. 2020**

- 10:00 **Zuzana Morávková**  
Raman spectroscopy of polyaniline
- 10:30 **Lenka Loukotová**  
Novel polysaccharide-based polymers for immunoradiotherapy
- 11:00 **Karel Dušek**  
Volume Phase Transition in Gels: its Discovery and Development
- 11:30 **Pavel Kratochvíl**  
Příspěvek Jiřího Podešvy "Pavel Kratochvíl a jeho vědecký přínos"

**Jak se dělá věda jinde**

**čtvrtek 6. 2. 2020**

- 14:15 **Jiří Kotek**  
Představení Evropské polymerní federace
- 14:30 **Daniel Grande**  
**(ICMPE, Université Paris-Est Créteil, France)**  
Porous materials with controlled pore morphology and functionality derived from functional polymers: *From design to application*
- 15:00 **Katja Loos**  
**(University of Groningen, The Netherlands)**  
Enzymatic polymerizations – making polymer synthesis more sustainable
- 15:30 **Jean-François Gerard**  
**(INSA Lyon, France)**  
Combining metal-oxo clusters and ionic liquids for modifying polymer networks

Informace o konání Kolokvia 2020 a případné změny v programu lze nalézt na:  
<https://www.imc.cas.cz/events/20kolok/>

**KOLOKVIUM  
2020**





# Abstrakty přednášek

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## A1 Miroslava Lukešová

### Electron paramagnetic resonance spectroscopy

The lecture about the electron paramagnetic resonance technique, its possibility of use and limitations.

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## A2 Nadiia Velychkivska

### Physico-chemical study of stimuli-responsive supramolecular systems

This study is undertaken to examine molecular interactions of water soluble porphyrin-polymer systems using a number of physico-chemical techniques. A "smart" porphyrin-polymer system exhibits both temperature and methanol-water composition dependence associated with the coil-to-globule transition, as well as a reversible protonation process upon decrease of pH with pronounce colorimetric change. Studied system can be used for pH or temperature sensing, and potentially as PDT photosensitizing agent.

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## A3 Josef Jůza

### Kompatibilizace polymerních směsí blokovými kopolymery

Lepší fázové struktury a zlepšení mechanických vlastností polymerních směsí se dosahuje kromě jiného kompatibilizací; jedním z jejich používaných způsobů je přidavek blokového kopolymery s jednotlivými bloky shodnými nebo kompatibilními s příslušnými objemovými fázemi. V nedávné době jsme propočítávali kompatibilizační působení popsané rovnicemi odvozenými na základě modelů Leiblera a Noolandiho. Nejúčinněji by dle výsledků výpočtu měly kompatibilizovat kopolymery s bloky srovnatelné délky s řetězci homopolymeru. Při delších řetězcích sice roste jejich obsah na povrchu, ale mezifázové napětí se snižuje již méně; při kratších řetězcích je větší podíl kopolymery zůstávajícího v objemové fázi.

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## A4 Lucie Woldřichová

### New types of phosphorus-containing polymers: from synthesis to application

The aim of this study is to develop new types of biocompatible phosphorus-based polymer carriers generally designed for site-specific delivery of various therapeutics with the potential of being used as contrast agent in the 31P-MR imaging. Specifically, this study focuses on synthesis and characterization of three types of carriers: (i) linear statistical copolymers based on 2-methacryloyloxyethyl phosphorylcholine, (ii) star polymers composed of cyclotriphosphazene cores modified with hydrophilic polymer arms, and (iii) linear polyphosphoesters. Controlled polymerization techniques and modern organic synthetic procedures have been used throughout this study to produce highly defined materials.

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## A5 Zulfiya Černochová

### Thermodynamics of the multi-stage self-assembly of pH-sensitive gradient copolymers in aqueous solutions

The self-assembly (SA) thermodynamics of pH-sensitive di-block and tri-block gradient copolymers of acrylic acid and styrene was studied using isothermal titration calorimetry (ITC) and dynamic light scattering (DLS) performed at varying pH. We were able to monitor each step of SA as a function of decreasing pH. The growth of micelles is a multi-stage process that is pH dependent with several exothermic and endothermic components. The minor change in heat capacity ( $\Delta C_p$ ) confirms the structural changes during this exothermic process. The pH-dependence of the zeta-potential of the copolymers micelles exhibits a plateau in the regime corresponding to pH-controlled variation of the micellar dimensions.

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## A6 Vladimír Raus

### Well-defined linear and grafted poly(2-isopropenyl-2-oxazoline)s prepared via copper-mediated RDRP methods

Successful reversible-deactivation radical polymerization (RDRP) of an important, double functional monomer 2-isopropenyl-2-oxazoline (IPOx) is reported for the first time. We demonstrate that well-defined poly(IPOx) can be obtained in quantitative conversions via aqueous Cu(0)-mediated RDRP using the 2-chloropropionitrile/CuCl(CuCl<sub>2</sub>)/TPMA initiation and catalytic system. Poly(IPOx) was then transformed into ATRP macroinitiators by the reaction with 2-bromoisobutyric or 2-chloropropionic acid. Subsequently, styrene and methyl methacrylate were grafted as model monomers from these macroinitiators. This approach provides a straightforward route to a new class of 2-oxazoline-based materials.

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## A7 Konstantin Milakin

### Conducting cryogels based on polyaniline and its derivatives

Polyaniline-based cryogels are materials combining physicochemical properties of the conducting polymer with mechanical characteristics of a polymer support. They are prepared by polymerization of the respective monomer in the frozen aqueous solution of the stabilizing polymer. Morphology, conductivity and mechanical properties of the resulting materials are determined by parameters and composition of the reaction medium and can be easily tuned for a potential application. The present work shows approaches for preparation of composite cryogels with controllable characteristics based on polyaniline and its derivatives.

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## A8 Vladimír Proks

### Xeno-free povrchy pro kultivace lidských embryonálních kmenových buněk - 1. část

Předkládaný příspěvek mapuje 10 let vývoje biomimetických protein-repuzivních povrchů pro kultivace lidských embryonálních kmenových buněk očima materiálového chemika a buněčného biologa.

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## A9 Josef Jaroš

### Xeno-free povrchy pro kultivace lidských embryonálních kmenových buněk - 2. část

Předkládaný příspěvek mapuje 10 let vývoje biomimetických protein-repuzivních povrchů pro kultivace lidských embryonálních kmenových buněk očima materiálového chemika a buněčného biologa.

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## A10 Veronika Gajdošová

### Micromechanical properties of polymers: detailed interpretation with the help of SEM and 3D-LM microscopy

Modern research often requires characterization of mechanical properties in microscale. In this contribution, we focus on detailed interpretation of microindentation hardness testing results on polymers. Our analysis of microindentation experiments performed at various conditions, combined with 2D- and 3D-microscopy of the indents on the polymer surfaces, proved that the final micromechanical properties are influenced by pile-up effect, i.e. by elasto-visco-plastic flow of the material around the indenter.

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## A11 **Jakub Širc**

### **Hydrogel implants for retinoblastoma therapy**

Retinoblastoma is the most common primary intraocular malignant cancer in childhood. Chemotherapy is the most effective treatment, however, systemic drug administration is connected with serious side effects. The hydrogel implants designed for the transscleral diffuse transport of chemotherapeutics into the eyeglobe may significantly increase the drug concentration in the target place and prolong the drug action, together with considerably lower total drug dose.

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## A12 **Zdeněk Starý**

### **Capillary rheometry - features and examples from applied research**

The contribution summarizes basic features of capillary rheometry and introduces the possibilities of measurements at conditions relevant for polymer processing. In the second part, few examples of the results obtained in the frame of applied research projects are presented.

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## A13 **Suzana Natourova**

### **High-performance protective coatings based on polyurea: Study of depth-dependent film formation processes**

## A14 **Kristýna Kolouchová**

### **Samouspořádané fluorované polymerní systémy na bázi poly[(*N*-2,2-difluorethyl) akrylamidu] jako diagnostické a theranostické kontrastní látky pro 19F MRI**

Polymery s dolní kritickou teplotou roztoku (LCST) zůstávají molekulárně rozpuštěné při laboratorní teplotě a po zahřátí tvoří samouspořádané částice nebo makroskopicky precipitují. Částice či precipitovaná depa mohou být použity pro diagnostiku, cílenou dopravu a řízené uvolňování bioaktivního nákladu nebo kombinace obou (teranostika). Naše koncepce je založena na kopolymerech obsahujících *N*-(2,2-difluorethyl) akrylamidovou monomerní jednotku. Díky vysokému obsahu fluoru v polymeru jsou tyto polymery zobrazitelné 19F MRI, slibnou neinvazivní zobrazovací metodou pro diagnostiku.

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## A15 **Jiří Czernek**

### **The NMR crystallography in the pursuit of a solid-phase structure of *N*-formyl-MLF-OH tripeptide**

NMR crystallography aims at exploiting synergies between solid-state NMR, X-ray diffraction, and computational techniques. Our NMR crystallography protocol has been recently extended to also include restraints obtained by NMR-established interproton contacts in order to study the chemotactic tripeptide *N*-formyl-MLF-OH (fMLF) whose crystal structure is unknown, despite of the significance of this compound, while our coworkers at the UCT Prague have independently solved the fMLF structure using the powder X-ray diffraction. Results of this blind test are discussed in terms of geometrical and crystal-packing motifs of fMLF, and are relevant for interactions involving *N*-formyl peptide receptors.

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## A16 David Babuka

### Investigation of the internal structure of thermoresponsive diblock P<sub>MeOx</sub>-b-PD<sub>FEA</sub> copolymer nanoparticles

The poly(2-methyl-2-oxazoline)-b-poly[N-(2,2-difluoroethyl)acrylamide] self-assembled nanoparticles show great potential in biological applications. The majority of the polymer in solution forms micelle-like structures above the cloud point temperature. However larger aggregates were also observed in dynamic light scattering experiments. To investigate internal structure of those particles a wide array of analytical methods was employed and it was determined that the larger aggregates are interconnected by hydrophobic networks and hydrogen bonds and contain large amounts of solvent.

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## A17 Sabina Abbrent Nováková

### Following copolymer chain formation of 2-oxazolines by *in-situ* <sup>1</sup>H-NMR spectroscopy

*In-situ* <sup>1</sup>H NMR characterization of copolymerization reactions of various 2-oxazoline monomers at different molar ratios offers detailed insight into the build-up and composition of the polymer chains. Various 2-oxazolines were copolymerized with 2-dec-9-enyl -2-oxazoline, where the double bond allows functionalization and can function as a crosslinking unit to create polymer networks.

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## A18 Małgorzata Świętek

### Phenolic compound-modified iron oxide nanoparticles. Are they effective tools to suppress oxidative stress?

Oxidative stress resulting from excessive production of radical oxygen species (ROS) is known to be associated with many diseases. It also induces cytotoxicity of nanoparticles, which limits their application in clinical practice. We used several phenolic compounds to enhance antioxidant properties of chitosan that was used to coat magnetic iron oxide nanoparticles. Such strategy resulted in improvement of nanoparticle uptake by fibroblast (L-929) and glioblastoma (LN-229) cells and significantly reduced intracellular ROS level. In addition, gallic-acid modified nanoparticles effectively suppressed oxidative burst in polymorphonuclear cells that are important in human immune system defense.

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## A19 Jana Kousalová

### Polymery pro inhibici MMP

Matrix metaloproteinázy (MMP) se jeví jako vhodný potenciální cíl protinádorové léčby. Jedná se o skupinu proteináz zodpovědných za degradaci a remodelaci membrán. MMP jsou ve vysoké míře obsaženy v různých maligních buňkách a jejich nadměrná exprese je spojena s agresivitou nádoru a tvorbou metastáz. Nejčastěji detekovány jsou v těchto tkáních MMP-2 a MMP-9. Aktinonin byl vybrán jako inhibitor uvedených MMP a kopolymer na bázi HPMA jako vhodný polymerní nosič pro tento inhibitor. Byla připravena série polymerních konjugátů lišících se v použité spojce k vazbě aktinoninu na polymer. U všech konjugátů byla změřena kinetika hydrolýzy při různých hodnotách pH a také *in vivo* aktivita.

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## A20 Jiří Trousil

### Beating intracellular bugs using nanobead-based interventions

One hundred years after antimicrobials and antibiotics discovery, intracellular bacterial pathogens remain a major cause of global morbidity and mortality. This is due to complex and intricate ability to intracellular replication while evading the host cells immune defense. Fabrication nanocarriers for drug delivery into the lungs, the primary site of pulmonary infection, offers an elegant way for the therapy. Our study utilizes graft and block amphiphilic copolymers to explore self-assembled drug delivery systems for the treatment of intracellular infections.

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## A21 Dana Kubies

### Alginate hydrogel beads as a platform for delivery of proteins

Alginate beads can serve as a delivery system of heparin-binding proteins such as VEGF, FGF-2 and CXCL12 with higher isoelectric points. The protein release can be controlled by additives present in the alginate matrix, when additives mask electrostatic interactions between used components. The released proteins retained their bioactivity.

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## A22 Richard Hoogenboom (speciální host)

### Ghent University, Belgium

### Poly(2-isopropenyl-2-oxazoline) as versatile platform for responsive polymers and supramolecular hydrogels

## A23 Marina Tavares

### Tumor-targeted polymer-based theranostics for photodynamic therapy

Tumor-targeted photodynamic therapy (PDT) using polymers carrying photosensitizers has been shown to be a promising therapeutic strategy for cancer treatment and diagnostics, because it enables generation of singlet oxygen ( $^1O_2$ ) species exclusively in the target tissue after light irradiation. Here, we present the synthesis of *N*-(2-hydroxypropyl) methacrylamide (HPMA) based-polymer conjugates with the photosensitizer pyropheophorbide-a and their *in vitro* and *in vivo* characterization.

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## A24 Olga Janoušková

### "Advanced" *in vitro* methods for evaluation of biological characteristics of polymer therapeutics and other nanomaterials

Makromolekulární systémy určené pro medicínské účely jsou nejčastěji hodnoceny z pohledu své biokompatibility či toxicity základními *in vitro* testy, které zahrnují sledování životaschopnost buněk, případně typ buněčné smrti či interekci materiálu s buňkami s využitím mikroskopie či průtokové cytometrie. My se dále cíleně zaměříme na detailní sledování širokého spektra biologických charakteristik polymerních terapeutik a nanomateriálů, a to na metody sledování imunomodulačních vlastností, antibakteriálních vlastností, migrační testy, typu endocytózy, vlivu na energetický metabolismus buňky, či využití *in vitro* 3D nádorových modelů nebo sledování přenosu terapeutik buněčnými vesikuly.

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## A25 Elena Tomšík

### Completely soluble PEDOT: self-polymerization of EDOT

## A26 Miloš Netopilík

### Retention mechanism of branched macromolecules in size exclusion chromatography

The theory of Stockmayer in the modifications of Thurmond and Zimm has been used for the description of the SEC separation of randomly branched molecules with tetrafunctional branch points. It is assumed that free chain-ends, created by the branching process, cause the molecules to be entrapped in the pores of the column packing with the time of their release given by the exponential law characteristic for the monomolecular reactions. Using this assumption, the anomalous elution behaviour of such molecules can be modeled.

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## A27 **Věra Cimrová**

### **Donor-acceptor copolymers with interesting properties for photonics**

Donor-acceptor copolymers with interesting properties for photonics prepared and studied in our laboratory will be reported.

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## A28 **Miroslav Menšík**

### **Field-effect transistors based on nano-brushed systems**

Charge transport in nano-brushed system significantly differs from that in amorphous polymer phases. For highly organized nano-brushes in crystalline-like domains, the charge delocalization along the respective chains must be treated by means of quantum approach, while the charge transport between chains is controlled semi-classically. We show that the applied electric field along the respective chains changes the charge mobility of such nano-brushed system in a very different way as in the case of the amorphous phase.

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## A29 **Markéta Bláhová**

### **Synthesis of PCL-graft-pHPMA copolymers for efficient tumor drug delivery**

Here, we present the synthesis and physico-chemical characterization of biodegradable amphiphilic graft poly( $\epsilon$ -caprolactone)-graft-poly[*N*-(2-hydroxypropyl) methacrylamide] copolymer (PCL-graft-pHPMA) copolymers. The PCL-graft-pHPMA was prepared by grafting of semitelechelic pHPMA copolymer prepared by RAFT polymerization onto PCL using click chemistry. The graft copolymer forms micelles with low CMC by simple dissolution in buffers and exhibits slow hydrolytic degradation due to PCL core. The PCL-graft-pHPMA is designed as a drug carrier either for covalent attachment of active molecules to HPMA chains, and/or for non-covalent entrapment of hydrophobic drugs to hydrophobic PCL core.

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## A30 **Michal Babič**

### **Polymerní kontrastní látky pro fotoakustické zobrazování**

Fotoakustická tomografie využívá schopnost světlo pohlcujících látek vytvářet kontrastní akustický signál po ozáření nanosekundovým světelným pulsem. Exogenní kontrastní látky představují vítané rozšíření diagnostických možností v prostorovém a časovém rozlišení zobrazovací metody. Projekt si klade za cíl rozšířit znalosti v oblasti polymerních kontrastních látek, které dosud byly, na rozdíl od nízkomolekulárních látek a drahých kovů, studovány jen okrajově.

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## A31 **Vladimir Sincari**

### **Reactive oxygen species (ROS)-responsive polymersomes with site-specific chemotherapeutic delivery into ROS-rich tumor *in vivo***

ROS such as, hydrogen peroxide ( $H_2O_2$ ), is a component of cell signalling pathways that are necessary for the growth, development, and fitness of living organisms. However, imbalances in  $H_2O_2$  production lead to oxidative stress and inflammation events, which damage tissue and organ systems and are correlated with the onset and advancement of various diseases, including cancer. Hence, the design of PS able to be responsive to these inherent feature of the TME has been proposed as a promising approach for the cancer treatment. A new oxidative responsive amphiphilic diblock copolymer was synthesized and tested *in vivo*.

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### **A32 Bartosz Paruzel**

#### **Optimization of multilayer structures for organic electronics**

Organic electronic devices have attracted an increasing attention in recent years due to the vision of a low-cost and large-scale production of printable electronics. Many papers published during the last decade focused on the intrinsic properties of organic conductors, semiconductors and dielectric materials. Since most of the devices consist of multilayer structures the mutual influence of the processes that take place in the particular layers is important for the functionality of the whole device. Hence, the characterization and understanding of those mutual interactions of the individual layer are of big significance.

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### **A33 Júlia Kudláčová**

#### **Polymeric nanoprobes for advanced flow cytometry**

New types of diagnostic nanoprobes for sensitive and easier detection of various cell types by flow cytometry were designed and synthesized. Nanoprobes are based on fluorescently labeled HPMA copolymers conjugated with various monoclonal antibodies. Different synthetic approaches for optimization of fluorescent intensities and optimized conjugation with antibodies will be described. Novel multispectral nanoprobe designed for fluorescent cell barcoding for multiplex flow cytometry will be also described. With this method individual cell samples are barcoded, or labeled, with unique signatures of fluorescent dyes so that they can be mixed together, stained, and analyzed as a single sample.

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### **A34 Miroslav Šlouf**

#### **Cryo-SEM and cryo-TEM microscopy: visualization of polymer hydrogels and nanoparticles**

Cryogenic electron microscopy can be employed in visualization of wet polymer samples, such as polymer hydrogels and polymer nanoparticles in solution. In a typical experiment, the sample is flash-frozen and observed at temperatures of liquid nitrogen in high vacuum (Cryo-HVSEM or Cryo-TEM). Alternatively, we observe samples at temperatures around -10C in low vacuum conditions (Cryo-LVSEM) or apply specific preparation methods to observe samples in high vacuum at ambient temperature (HVSEM and TEM). We will introduce all above mentioned electron microscopy techniques with special emphasis on recently installed Cryo-HVSEM method that is available on high-resolution FEGSEM microscope MAIA3.

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## Přednášky oceněných pracovníků

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### B1 Zuzana Morávková

#### Raman spectroscopy of polyaniline

Main focus of this talk will be the comparison of various degradation means and processes in a polyaniline film, studied by Raman microspectroscopy.

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### B2 Lenka Loukotová

#### Novel polysaccharide-based polymers for immunoradiotherapy

A conceptually new cancer treatment, immunoradiotherapy, was demonstrated using polysaccharide-graft-poly(2-isopropyl-2-oxazoline-co-2-butyl-2-oxazoline) bearing complexes of DOTA with yttrium-90(III) at the graft ends. Such polymers were designed to show immunostimulatory activities, to be able to create a polymer depot after an injection in aqueous solution and to be locally radioactive. They were used during *in vivo* antitumor efficiency experiments on mice with EL4 lymphoma, while the experiment demonstrated an extraordinary treatment success, indicating the considerable synergistic effect of using immunoradiotherapy compared to separately using immunotherapy or radiotherapy.

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### B3 Karel Dušek

#### Volume phase transition in gels: its discovery and development

In the course of studies of macroporous polymer networks, the thermodynamic criterion for phase separation during network formation was formulated (Dušek 1964,1965). It was found that a first order phase transition could exist characterized by a large change in the degree of swelling (Dušek, Patterson 1968). Ten years later (1978) T. Tanaka discovered such transition experimentally on swollen and aged (ionized)polyacrylamide gels, and interpreted it independently using the same model. Since then, many other gels showing such transition were found and  $10^4$  papers were published. Many aspects remain unclear stemming partly from inadequacy of the routinely applied model.

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### B4 Pavel Kratochvíl

#### Příspěvek Jiřího Podešvy "Pavel Kratochvíl a jeho vědecký přínos"

Přednáška v souvislosti s oceněním prof. Pavla Kratochvíla za celoživotní přínos Akademii věd.

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## Jak se dělá věda jinde

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### C1 Daniel Grande

#### (ICMPE, Université Paris-Est Créteil, France)

Porous materials with controlled pore morphology and functionality derived from functional polymers: *From design to application*

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### C2 Katja Loos

#### (University of Groningen, The Netherlands)

Enzymatic polymerizations – making polymer synthesis more sustainable

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### C3 Jean-François Gerard

#### (INSA Lyon, France)

Combining metal-oxo clusters and ionic liquids for modifying polymer networks

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