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**- Selection of Abstracts -**

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## HIGHLIGHTS IN ADVANCED MEDICINE

*The Tribune of the Practitioner*

### 1. DENTAL CARIES - BIOLOGICAL APPROACH OR CONVENTIONAL TREATMENT?

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#### Abstract

Given the increasing emphasis on the prevention of dental caries, the epidemiological reality still requires more attention for the curative treatment itself, obviously with nuances derived from the contribution of new knowledge in the field of basic sciences and improving the quality of restorative materials. These nuances have led to the proposal and introduction of the concept of Minimal Intervention Dentistry (MID), a concept that gives the practitioner the opportunity to opt for a biological approach at the expense of conventional, conventional treatment. After the presentation of the MID concept, at the end of the presentation, the idea is emphasized that the two treatment modalities, biological and conventional, are not mutually exclusive, but are chosen according to the existing clinical situation, essentially preferring techniques as conservative, individualized.

**Keywords:** *dental caries, MID, dentistry.*

### 2. INDICATIONS AND CONTRAINDICATIONS FOR ENDODONTIC RETREATMENT

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#### Abstract

Endodontic retreatment has been and continues to be a real test for many of the colleagues in front of a tooth with endodontic pathology that has also undergone other interventions in the root canals. Often the results of an endodontic retreatment are not as expected and a whole complex of factors contribute to this, including the correct determination of the retreatment indication. Since there is no medical treatment (particularly dental) that does not present risks or side effects, I believe it is imperative to know exactly the indications and contraindications of endodontic retreatment and apply it correctly, only where appropriate. The conference aims to review, with theoretical and practical arguments, the diagnostic situations that require an endodontic retreatment, as well as some concrete situations in which this therapeutic maneuver is erroneously used.

**Keywords:** *endodontic retreatment, root canal, dentistry.*

### 3. IMPROVING COMMUNICATION WITH THE PATIENT ACCORDING TO HIS PSYCHOSOCIAL PROFILE

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#### Abstract

Depending on the type of patient in contact with the medical staff, various specific ways of communication are used. The efficient accomplishment of the activities in the context of the medical care depends to a large extent on the adaptation of the communicative act to the psychosocial particularities of the patient. Depending on the psychosocial profile, several types of patients and

appropriate ways of interacting with them are highlighted: dramatic patient, depressed patient, suspicious patient, antisocial patient, patient with high economic and social status, medical patients. The psychosocial profile of the patient can condition different types of emotional reactions to communication with him, and different communication strategies in relation to them. The literature lists a number of emotional reactions commonly encountered in communicating with a patient. These include: depressive / despair reactions, fear and anxiety reactions, denial reactions, anger reactions, self-blame reactions, distrust reactions.

**Keywords:** *psychosocial profile, communication, medical care.*

#### 4. ANTICIPATORY CRITERIA IN DENTAL MEDICINE

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##### **Abstract**

One of the fundamental characteristics of human activity is its ability to anticipate its concerns on the theoretical or practical side. The anticipatory pillars in the evolution of dental medicine are related to the evolution of medicine in general and to the emergence of new technologies with medical application coming either from pharmacology, from the area of artificial intelligence or from the field of biology. An essential criterion is the didactic act that is called to make the transfer of new concepts and knowledge to the generations of specialists in the educational process.

**Keywords:** *anticipation, dentistry, modern learning, artificial intelligence.*

#### 5. THE FIFTH STATE OF MATTER

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##### **Abstract**

What Is The 'Fifth State of Matter'? There are four states of matter common in everyday life – gases, liquids, solids, and plasmas. However, there is also a fifth state of matter – Bose-Einstein condensates (BECs), which scientists first created in the lab 25 years ago. When a group of atoms is cooled to near absolute zero, the atoms begin to clump together, behaving as if they were one big super-atom. The existence was predicted by Albert Einstein and Satyendra Nath Bose almost a century ago, are formed when atoms of certain elements are cooled to near absolute zero (0 Kelvin, minus 273.15 Celsius). The atoms become a single entity with quantum properties, wherein each particle also functions as a wave of matter, at this point. The key to unlocking one of the greatest mysteries of the Universe and life might lie in the rarest and most extreme of all the known states of matter.

**Keywords:** *fifth state of matter, Bose-Einstein condensates, Albert Einstein.*

#### 6. MICROBIAL BIOTERRORISM

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##### **Abstract**

The use of microbial pathogens as potential weapons of war or in acts of terrorism dates back to ancient times. Protection against such attacks requires a combination of: basic research, good medical practice, constant vigilance. An important goal of bioterrorism is to destroy the morale of a society through fear and insecurity. Bioterrorism agents can be used in their natural form or deliberately modified to ensure maximum impact. Among the microbial agents used in bioterrorism are: Bacillus

anthracis, *Clostridium botulinum* (toxin), *Yersinia pestis*, smallpox virus, *Francisella tularensis*, hemorrhagic fever viruses (Ebola, Marburg), *Clostridium perfringens*, *Salmonella* species, *Shigella*, *Escherichia coli* O157: H7, *Vibrio cholerae*, *Cryptosporidium parvum*, etc. The prospect of a deliberate attack on civilians with infectious agents that cause disease may seem like a bad thing, but history shows that it is an action that has been done in the past and will probably be done again in the future.

**Keywords:** *microbial pathogens, bioterrorism, hemorrhagic fever viruses.*

## 7. ANTIMICROBIAL ACTIVITY OF INNOVATIVE COMPOSITE HYDROGELS WITH POSSIBLE APPLICATIONS IN THE TREATMENT OF PERIODONTITIS

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### Abstract

The main strategy in the treatment of periodontitis is to establish adequate control of the infection. In this context, hydrogels with potential antibacterial properties may be a promising alternative. Staphylococcus reference strains of *Staphylococcus* (Gram-positive bacteria) and *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* (Gram-negative bacteria). The most important antimicrobial activity of ZnONP-containing hydrogel samples was *Staphylococcus aureus*. These samples also showed an antimicrobial effect on the strains of *Escherichia coli* and *Klebsiella pneumoniae*. The increase in the amount of AgNPs in hydrogels has led to an increase in antimicrobial activity on *Staphylococcus aureus*; the hydrogels tested did not show antimicrobial activity on the *Escherichia coli* strain.

**Acknowledgment.** *This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI- UEFISCDI, project number PN-III-P2-2.1-PED-2019-1780, within PNCDI III "*

**Keywords:** *periodontitis, hydrogels, antibacterial properties.*

## 8. MÉNIÈRE'S DISEASE

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### Abstract

Ménière's disease is a progressive condition that occurs more frequently in people between the ages of 40 and 60 and usually manifests in the monoauricular, causing sensory hearing loss for low frequency sounds. The symptomatic treatment of Ménière's disease aims to reduce the clinical manifestations and aims to reduce dizziness, nausea and vomiting that prevent the daily activities of the patient, by using antiemetics, diuretics and vestibulo-suppressive preparations (benzodiazepines). The etiological treatment can be medicinal or surgical and aims to reduce inflammation of the vestibular system. The medical recovery applied in the case of Ménière's Disease consists in the re-education of the vestibular and the observance of a specific hygienic-dietary regime.

**Keywords:** *Ménière's disease, inflammation, vestibular syndrome.*

## 9. CLINICAL HETEROGENEITY IN EARLY DIAGNOSIS IN PSORIATIC ARTHRITIS

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### Abstract

**Introduction.** Psoriatic arthritis (APs) is one of the major inflammatory diseases of the joints and spine. The aim of the study was to identify the characteristics of joint syndrome and skin lesions in patients with early APs. **Materials and methods.** The current study included 104 patients with APs



who were hospitalized in the rheumatology and arthrology wards of the IMSP Republican Clinical Hospital "Timofei Moşneaga" from 2003 to October 2021. **Results and discussions.** The frequency of expression of the clinical-anatomical variants of the joint syndrome was different in patients with early-APs and late-APs, oligoarthritis was significantly more common (43.1% and 19%, respectively,  $p = 0.01$ ) and less common, spondyloarthritis (7.8% and 19%,  $p = 0.1$ ), while polyarthritis (33.3% and 38%,  $p = 0.6$ ) and distal interphalangeal (15.7% and 15%,  $p = 0.9$ ), the mutilating variant was observed only in late APs. **Conclusions.** The early stage of psoriatic arthritis is characterized by pronounced heterogeneity of the manifestations of joint syndrome and tendon-ligament lesions.

**Keywords:** psoriatic arthritis, clinical case, oligoarthritis, spondyloarthritis, polyarthritis.

## 10. TRIGGER IMPACT OF CHLAMYDIA TRACHOMATIS IN SERONAGATIVE SPONDYLOARTHRITIS

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### Abstract

Currently, the clinical manifestations, changes in laboratory parameters and the results of joint instrumental and spine examinations in Seronegative Spondyloarthritis (SpA) with the trigger role of Chlamydia trachomatis are not fully elucidated. The aim of the study was to identify the particularities of the clinical manifestations, diagnosis and evolution of seronegative spondyloarthritis associated with Chlamydia trachomatis infection. Objectives of the study: To appreciate the significance of Chlamydia trachomatis in the development of SpA.

### Conclusions:

1. Chlamydia trachomatis infection was detected using the chain polymerization reaction in the urogenital tract (89.7%) and serum by ELISA (10.3%).
2. SpA associated with Chlamydia trachomatis infection has more pronounced clinical, laboratory and instrumental manifestations both at the onset and in the advanced stage of the disease.
3. SpA axial form associated with Chlamydia trachomatis infection, as opposed to spondyloarthritis without concomitant infections, is characterized by the involvement of small joints of the hands and soles in the pathological process at the onset of the disease.

**Keywords:** chlamydia trachomatis, Spondyloarthritis, trigger impact.

## 11. BONE SYSTEM PATHOLOGY IN PATIENTS WITH RHEUMATOID ARTHRITIS

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### Abstract

**Introduction:** The aim of the study was to determine the condition of bone mineral density in patients with rheumatoid arthritis. **Materials and methods:** 95 patients with rheumatoid arthritis were examined. DXA, an osteoporosis diagnosed according to WHO criteria, was performed to determine the condition of the bone tissue. The data obtained were statistically analyzed. **Results and discussion:** Of the patients examined, 88.4% were women and 11.6% were men. The average age is  $58.2 \pm 9.5$  years. Of the women, 82.1% were postmenopausal. 80% were positive for rheumatoid factor and 88% positive for anti-CCP antibodies. Osteoporosis was diagnosed in 37.9%, osteopenia in 29.5% and in 32.6% of cases the normal bone mineral density was determined. 33.3% of patients with osteoporosis had severe form due to the presence of compressed fractures in the spine, 8.3% due to fracture of another location. **Conclusions:** Bone damage is common in patients with rheumatoid arthritis. It is necessary to perform early DXA to determine the pathology and apply early treatment.

**Keywords:** rheumatoid arthritis, bone system pathology, DXA.

## 12. COMORBID PATHOLOGY AMONG PATIENTS WITH PSORIASIS ARTHRITIS OF YOUNG AND MIDDLE AGE

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### Abstract

Comorbidities should be considered in the management of psoriatic arthritis because they contribute to the increase of early mortality, increase the activity of the disease and influence the response to treatment. The aim of the study was the analysis of the frequency and nature of comorbid pathology in patients with psoriasis arthritis of young and middle age. In order to achieve the purpose and objectives of the study, a group of 92 patients with psoriatic arthritis, selected according to the CASPAR (2006) diagnostic criteria, was selected. In patients with psoriatic arthritis of young and middle age, a high frequency of comorbid pathology was observed: in 60.9% of patients, more than one comorbid pathology was observed, with the highest frequency of diseases of the musculoskeletal system. -skeletal (42.4%), cardiovascular (41.3%) and diseases of the digestive system (41.3%).

**Keywords:** psoriasis arthritis, comorbidities, case study.

## 13. PARASITOSIS WITH PATHOLOGICAL MANIFESTATIONS OF THE LOCOMOTOR SYSTEM

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### Abstract

This research was based on 80 subjects who were positively diagnosed with various parasites (toxocara canis (38 people), echinococcus granulosus (8), giardia intestinalis (23), toxoplasma (11) with musculoskeletal disorders, and 38 men were included in the study. 47.5%) and 42 women (52.5%). The age of the patients varies from 18 to 63 years, the average age being 38 years. The presence and characteristics of the following musculoskeletal entities were analyzed - arthralgias, arthritis, locomotor functional disorders, myalgias, myositis, osalgia, bone deformities, enthesitis, fatigue. Arthralgia-73.7%, myalgia-57.9%, osalgia-50%, arthritis-31.6% and myositis-13.2% predominate in the group of subjects with toxocara. In the group with echinococcus, myalgias, arthralgias, osalgias present 62.5% each, arthritis is at 50%, bone deformities at 25%. In patients with toxoplasmosis, arthralgia presents all subjects, myalgia 72.7%, osalgia 45.5%, arthritis 36.7%, myositis 27.3% and enthesitis 18.2%. All subjects with giardia had arthralgias, osalgias-56.6%, myalgias 43.5%, arthritis 21.7% and enthesitis-17.4%.

**Keywords:** parasitosis, locomotor system, parasites.

## 14. POSSIBILITIES OF DIAGNOSIS IN EARLY RHEUMATOID ARTHRITIS

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### Abstract

**Introduction.** ACPA and FR are those immunological markers that determine the serological type of rheumatoid arthritis (RA): seropositive (PRsp) and seronegative (PR sn). The sensitivity and specificity of the ACR / EULAR Classification Criteria 2010 for rheumatoid arthritis is approximately 75%, so it is proposed to apply ultrasonography (USG) in the early diagnosis of PRsn. **Materials**

**and methods.** 102 patients were included. Radiocarpal joints, MCP (II-V), PIP, MTP and talocrural joints were examined clinically and ultrasonographically. The USG examination assessed - the presence of synovial proliferation, the evaluation of synovial vascularization with Power Doppler (PD), the presence of erosions, tendonitis and tenosynovitis. **Results and discussion.** At the USG examination - the presence of synovitis and erosions was significantly higher in the HIV-positive group. Tenosynovitis and tendinitis were present in the seronegative group. **Conclusions.** Ultrasound examination is important in diagnosing RA in clinical practice. Contributing factors differ in the presence or absence of seropositivity, and complementation with ultrasound examination has been particularly useful in patients with seronegative RA.

**Keywords:** *rheumatoid arthritis, synovitis system, diagnosis.*

## 15. GOUT AND METABOLIC SYNDROME

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### Abstract

**Objectives:** To determine the prevalence of metabolic syndrome (MS) in patients with gout, and study its manifestations depending on the nature of renal disease. **Materials and methods:** 365 patients with gout have been examined: 310 with chronic gout, 55 with acute gout. Age from 18 to 81 years old. Disease duration was between 1 and 42 years. **Results and discussion:** Joint involvement: the first MTP joint - 298 (81,6%), by ankle joints in 186 (50,9%), knee joints in 159 (43,5%), the joints of the upper limbs - 119 (32,6%) patients. Kidney involvement - 174 (47,7%) patients had tubular-interstitial nephritis with uric acid diathesis, 162 (44,4%) patients had nephrolithiasis. MS was diagnosed in 189 (51,8%) patients with gout, a Waist Circumference of > 94 cm was seen in 189 (51,8%), triglycerides > 1.7 mmol/l in 178 (48,8%), glucose > 6.1 mmol/l in 161 (44,1%) patients. Decreased glomerular filtration rate below 60 ml/min - 164 (44,9%) of gout patients with MS, 48 (13,1%) patients without MS. Systolic BP > 135 mmHg - 274 (75%) patients. **Conclusion:** All of the above results correspond to data from international studies pointing to the fact that the presence of the metabolic syndrome in patients with gout leads to organ damage, regardless of geographic location, but depends on disease duration.

**Keywords:** *gout, metabolic syndrome, case study.*

## 16. STUDY ON THE INCIDENCE OF POSTPARTUM WHITE SPOT LESIONS AND THE EFFICACY OF ICON TREATMENT

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### Abstract

Fixed orthodontic treatment offers many benefits to patients - improved occlusal function, harmonious aesthetics in the dental display and self-confidence. Fixed produces rapid demineralization so that in 4 weeks the opaque white lesions are obvious. Recent studies show that the frequency of white spot lesions on the vestibular faces of the teeth is 38% for patients under 6 months of orthodontic treatment and 46% for those under 12 months of treatment. Boersma's study shows that 97% of patients Orthodontists have 1 or more white spot lesions. Maximum demineralization occurs in the first 6 months of treatment. Mattousch's study shows that 40% of postorthodontic adamantine lesions heal, 45% remain stable, and 15% are complicated by cavity lesions.

**Keywords:** *orthodontics, white spot lesions, demineralization.*

## HIGHLIGHTS IN ADVANCED MEDICINE

*Frontiers of knowledge in neuroscience*

### 1. ROBOTICS IN NEUROSURGERY

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#### Abstract

**Introduction.** Robotics is a developing domain of interests and is widely changing the practice of neurosurgery. The main goals of robotics in neurosurgery are to reduce the amount of operating time, reduce the error by making more precise steps, to access areas that are impossible or ranked as being to dangerous for the hand of neurosurgeon. The first ever used robot in neurosurgery was PUMA 200 robot, a machine that was designed for industrial use and by which there were performed biopsy. However, the first FDA-approved robot was NeuroMate robot. Since then, technology has evolved so much. One kind of robotic machineries that are used today are the tele-robots (e.g. neuroArm). This kind of robots are incorporated into MRI, so the patient can benefit of both intraoperative monitoring and surgical robotic tumor removal. This type of robots were invented especially to be tremor-free and more precise than human dexterity. One of the first robots that were controlled entirely from remote was the Cyber Knife, a platform developed by John Adler, Stanford University in 2002. This robot allowed for execution of the procedure without direct surgeon-patient contact. **Materials and methods.** Robots that are compatible with MRI have been used for stereotactic neurosurgery in Deep Brain Stimulation. Stereotaxy requires high-field MRIs (1.5-3 Tesla). Non-MRI compatible robots could achieve sufficient accuracy for electrodes placement in 75% of the cases, but the successful rate should be higher. Thus, the necessity for robotic compatible MRI was high. The issue that should be overcome regarding robotics and MRIs is the use of metallic tools inside the machinery. **Results and discussion.** To visualize continuously an update image is crucial. Therefore, piezoelectric and pneumatic actuators were adapted to robotic manipulation inside MRI. The second type of robots that can be used is handheld shared/controlled systems which is a robotic system designed to expand the human's ability to perform small-scale tasks. In this kind of interventions surgical tools are held simultaneously both by operator and robot arm. An example could be "Steady Hand System" designed by John Hopkins University, Baltimore, Maryland, US. There are factors that influence the function of the robot especially the mechanical ones. Consequently, the design of the robotic arm and the attached tools are contributing to the function of the robot. Tools could be rigid and have 6 degrees of freedom - which are encountered in every common machinery but there also could be curved tools that could be displayed as long tube with several tubes nested inside and could be used for approaching highly risked areas. Regarding multiple arms robots, the da Vinci Surgical System (Intuitive Surgical, Inc) was used for 2 cadaver experiments to simulate operating room steps. EndoWrist One Suction/Irrigator was used for supraorbital keyhole approach. After manually eyebrow incision and craniotomy, da Vinci Surgical System was used to open the dura via robotic curved scissors. CSF was partially suctioned by robotic arm suction/irrigator. The robotic endoscope provided 3-D visualization of the anterior and middle skull base fossa. Satisfactory dissection was provided around neurovascular structure. Thus, the



advantages of using this robotic-assisted technology are deep-vision and better handling stability. There are also drawbacks, such the lack of a rapid skull craniotome and possible improper placement of the robotic arms increasing the risk of arms collisions. Nowadays, robotics are not used just for intracranial interventions but also for spine injuries. Used both in spine and orthopaedics surgeries Mazor X Stealth designed by Medtronic is a robotic guided system that allows both pre-operative and intra-operative planning. This type of robots are used selecting implant trajectories and 3D analytics making the procedure more predictable. Besides conventional robotic arms these days robotic exoscopes are used for numerous intraoperative procedures. Exoscopes permits the neurosurgeon to overcome the reduced illumination of microscopes and allows the neurosurgeon to have better visualisation of brain structures from different angles. Even though the microscope is the world-wide device used neurosurgery, it has some limitations such as the binocular lenses are attached to the microscope and determines neurosurgeon to bend or to move along with the microscope and secondly, the illumination for in-depth procedure is reduced. To overcome all of these limitations application of exoscopes comes with high-quality 3D image, better illumination and hands-free camera movement. Future perspectives for robotics in neurosurgery may focus on completely independent robots into the operation rooms. This autonomous robots, however, pose some challenges since each case is different. Currently, no robot could adjust moving on demand, thus they are used just for stereotactic assistance or equipment positioning alone. The next step in robotic movement development would be incisions or closing suturing step. Multiple robotic arms may work along neurosurgeons in a hybrid surgery. **Conclusions.** In conclusion, robotics in neurosurgery is a developing and promising feature. Neurosurgery is improving its assets continuously. Whether robots are used along side humans or totally controlled remotely, they represent a solution to the limitations of conventional surgery. Robots could be used in both cerebral and spine interventions, for both neuro-oncology and functional neurosurgical cases.

**Keywords:** *robotics, neurosurgery, stereotaxy, MRI 3 Tesla.*

## 2. TRANSLATIONAL TECHNOLOGIES IN NEUROSCIENCE

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### **Abstract**

The basic pathology of neuropsychiatric diseases is characterized by inflammation, neurodegeneration and continuous systemic alterations at different levels. It is important that certain specific abnormalities occur continuously throughout the course of the disease and play a key role in the symptomatic impairment and long-term evolution. Most of these processes cannot be accurately quantified in the human model. An accurate understanding of distinct disease-related fingerprints can be obtained by using translational models. Unmasking complementary pathways of tissue damage and repair in the human model and in rodents could provide important answers to the interindividual evolution of diseases. The presentation will cover innovative methods and recent results specific to the multimodal characterization of the processor in neuroinflammatory diseases (multiple sclerosis) and neurodegenerative diseases.

**Keywords:** *neuroscience, neuropsychiatric diseases, neurodegeneration, neuroinflammatory diseases.*

## 3. PATIENT DEXTRALITY AND EPILEPSY

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### **Abstract**

**Introduction:** Surgical treatment is the option of choice for the treatment of drug-resistant epilepsy with the evaluation of the prognosis and the avoidance of post-interventional neurological deficit. **Aim:** To evaluate the dextrality of patients with epilepsy to determine the clinical and predictive

value in the post-interventional neurological deficit. **Materials and methods:** An analytical study was conducted in which 315 patients with nocturnal, diurnal and mixed epileptic seizures were enrolled, of which 152 (48.3%) men and 163 (51.7%) women. Patients' dexterity was determined using Coren's (1993) preferential laterality questionnaire. **Results and discussion:** The mean age of the patients examined was between  $18.9 \pm 1.3$ ,  $26.5 \pm 1.6$  and  $26.7 \pm 1.8$  years for patients with nocturnal, diurnal and mixed seizures. Right-handed patients accounted for 89.6%, 88.9% and 89.2% ( $\chi^2 = 0.029$ ;  $p > 0.05$ ). **Conclusion:** Patients' dexterity does not differ significantly depending on the circadian rhythm, is comparable to that of healthy subjects and should be considered in the surgical treatment of epilepsy.

**Keywords:** *epilepsy, seizures, dextrality, prognosis.*

#### 4. HIGH-DENSITY EEG REVEALS THE ORIGIN IN THE FRONTAL LOBE OF GENERALIZED INTERICTAL DISCHARGES IN PATIENTS WITH MYOCLONIC SEIZURES

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##### Abstract

**Introduction:** Recent studies suggest a focal origin of myoclonic seizures. We aimed to assess the cortical sources of generalized interictal discharges in patients with myoclonic seizures using high-density EEG (HD-EEG). **Materials and methods:** We included 40 patients ( $25 \pm 7$  years; 14 men), examined by 3T MRI and HD-EEG. **Results and discussion:** Electrical sources were detected in the frontal lobe. At 17 (42%) patients - in the middle frontal gyrus (Brodmann area (BA) -9 in 7 patients, BA-10 in 3 patients, BA-6 in 4 patients and BA-8 in 3 patients). In 13 (33%) patients in the superior frontal gyrus (BA-6 in 9 patients, BA-10 in 3 patients and BA-8 in 1 patient). In 10 (25%) patients in the lower frontal gyrus (BA-11 in 8 patients and BA-46 in 2 patients). **Conclusions:** HD-EEG data suggest that myoclonic seizures are not truly generalized seizures in the sense of global cortex activation, but primarily recruit frontal lobe networks.

**Keywords:** *myoclonic seizures, EEG, frontal lobe.*

#### 5. TRANSCRANIAL MAGNETIC STIMULATION IN MIGRAINE PROPHYLAXIS. RESULTS OF AN EXPERIMENTAL, DOUBLE-BLIND, RANDOMIZED CONTROLLED STUDY

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##### Abstract

Episodic migraine is a debilitating condition associated with vast impairments of health, daily living and life quality. Several prophylactic treatments exist, having a moderate ratio of action related to side effects and therapy costs. Repetitive transcranial magnetic stimulation (rTMS) is an evidence base therapy in several neuropsychiatric conditions showing robust efficacy in alleviating specific symptoms. However, its efficacy in migraine disorders is unequivocal and might be tightly linked to the applied rTMS protocol. We hypothesized that multifocal rTMS paradigm could improve clinical outcomes in patients with episodic migraine by reducing the number of migraine days, frequency and intensity of migraine attacks, and improve the quality of life. We conducted an experimental, double-blind, randomized controlled study by applying an innovative rTMS paradigm. Reduction  $>50\%$  from the baseline in migraine days (as primary outcome) and frequency and intensity of migraine attacks (as key secondary outcomes) over a 12-week period were assessed.

**Keywords:** *migraine, repetitive transcranial magnetic stimulation (rTMS), randomized controlled study.*

## 6. ATYPICAL CAUSES OF STROKE - FACIAL EXPRESSIONS AND CHAMELEONS

MD Alexandru Gasnaș<sup>1</sup>

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### Abstract

In the case of "typical" ischemic strokes, a patient experiences sudden onset of symptoms such as facial asymmetry, weakness of the arms, and speech disorders (FAST). Two scenarios must be considered: a false positive "mime" and a false negative "chameleon". Stroke may occur atypically and may not be immediately recognized. Stroke mimicry -30% of probable stroke admissions. Stroke mimics: Todd's paresis, complicated migraines, functional or conversion neurological disorders, subarachnoid hemorrhage, hypoglycemia / hyperglycemia / severe, hyponatremia / metabolic encephalopathy, hypertensive encephalopathy / PRES, peripheral vertigo, Guillain Barre, myasthenia gravis abscess, encephalitis, syncope, sepsis. The most common chameleons identified were: altered mental state / toxic metabolic encephalopathy, syncope, hypertensive emergency, systemic infection / sepsis, dementia. The problem of chameleons is more serious than that of mimics, because patients are not identified in time and are not treated properly. Physicians should consider the pathologies mentioned above for proper management.

**Keywords:** *ischemic stroke, FAST, neurological disorders.*

## 7. PROFESSOR ALEXANDRU MORUZI - THE FOUNDER OF IASSY NEUROSURGERY

PhD Student Horia Berceanu<sup>1</sup>, Acad. Stanislav Groppa<sup>1</sup>

<sup>1</sup>"Nicolae Testemiteanu" State University of Medicine and Pharmacy, Republic of Moldova

### Abstract

Alexandru Moruzi (1900-1957), descended from a family with lordly genealogy, completed his high school studies in Paris (Louis le Grand High School), then enrolled in the Faculty of Medicine. During his internship in Paris, he completed two internships in the service led by doctor Robineau, from the Necker Hospital, famous for his orthopedic skills, but especially for neurosurgery. After completing his PhD thesis, in 1929, he continued his neurosurgical training in the departments of doctors M. Robineau and Th. of Martel. He returned to Romania and between 1930-1932 was the assistant of the professor of surgery Amza Jianu at the Colțea Hospital in Bucharest. In January 1933, he inaugurated the first neurosurgery service in the capital of Moldova at the Socola Hospital in Iassy, with the support of neuropsychiatry professor Leon Ballif. In 1935 he became Professor Ballif's assistant, and in 1938 he took the position of Surgical Therapy and Urinary Tract Disease professor. During the war, he performed surgical and neurosurgical cases in inland hospitals or near the front line. After the war, for political reasons, he emigrated initially to Venezuela, later to the USA, being recognized as a professor of surgery. He has published or communicated over 100 scientific papers in France and Romania.

**Keywords:** *Alexandru Moruzi, neurosurgery, Socola Hospital from Iassy.*

## 8. POST-STROKE DEPRESSION: CHALLENGE, REDEFINING, TOPICALITY

MD. Tatiana Bălanuță<sup>1</sup>, Acad. Stanislav Groppa<sup>1</sup>

<sup>1</sup>"Nicolae Testemiteanu" State University of Medicine and Pharmacy, Republic of Moldova

### Abstract

Post-stroke depression manifested as a mood disorder such as negative hyperthermia, which is associated with concentration hypoprosia, micromanic ideation, bradypsychia, decreased motor activity to psychomotor inhibition, and abolition is important to be reevaluated periodically. Strict

adherence to the evaluation protocol can lead to significant improvements in the patient's quality of life. The immediate physical and psychological impact of the vascular event on the patient's social and physical status have been identified as the underlying causes of this evolution. In addition to drug or psychotherapeutic treatment, repetitive transcranial magnetic stimulation (RTMS) is currently being used as a new non-invasive therapy for depression. Waves with a frequency 1Hz lead to a reduction in the excitability of neurons and an inhibition of cortical activity. In contrast, frequencies  $\geq 5$  Hz increase the excitability of neurons and increase cortical activity.

**Keywords:** *depression, stroke, repetitive transcranial magnetic stimulation (rTMS).*

## 9. POST-TRAUMATIC STRESS DISORDER IN EPILEPSY. CLINICAL CASE

SR PhD Student Elena Condratiuc<sup>1,2</sup>

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<sup>2</sup>"Nicolae Testemiteanu" State University of Medicine and Pharmacy, Republic of Moldova

### Abstract

**Introduction:** In a patient experiencing epilepsy, the following points are essential: the patient's experience of seizures and their psychosomatic quality. The involvement of doctors is not only to cure the disease, but also to take into account all the surrounding factors (social, family). **Materials and methods:** The patient was referred to the National Center for Epileptology at the age of 15 with an established diagnosis of epilepsy. The evolution of the seizures took place in two stages: a marked decrease in the frequency of seizures under anticonvulsant treatment, but, subsequently, the onset of emotionally triggered seizures. **Results and discussion:** From a psychosomatic point of view, a person with epilepsy is constantly confronted and feels so strong that it manifests itself physically. **Conclusion:** During the psychotherapy sessions, the doctor showed his emotional involvement in the human relationship. This requires a lot of discussion, advice and real patient education.

**Keywords:** *epileptic seizures, mental trauma, psychotherapy.*

## 10. CERVICAL ARTERY DISSECTION - THE CAUSE OF STROKE IN YOUNG ADULTS. CLINICAL CASE

PhD student Daniela Efremova<sup>1,2</sup>, Assoc. Prof. PhD Eremei Zota<sup>1,2</sup>, MD Diana Manea<sup>2</sup>, MD Igor Crivorucica<sup>3</sup>, MD Olga Bucataru<sup>2</sup>, MD Irina Smetanca<sup>2</sup>, Acad. Stanislav Groppa<sup>1,2</sup>

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### Abstract

Cervical artery dissection is a major cause of stroke in young adults. Although the pathophysiology is unclear, it is thought to be a multifactorial disease, with an interaction between environmental and genetic factors. Its clinical signs and symptoms may be vague and the diagnosis may be delayed. In this context, we report a case of vertebral artery dissection and ischemic stroke in a 22-year-old woman, as a result of a combination of anatomical and environmental risk factors. The detailed anamnesis, the clinical examination, the neurological examination, the imaging investigations allowed to establish the correct diagnosis, the appropriate treatment and the measures of secondary prevention of the stroke. This case highlights the importance of a detailed medical history to identify risk factors and potential rare causes of stroke, especially in young adults. Also, that the role of environmental factors should not be underestimated.

**Keywords:** *epileptic seizures, mental trauma, psychotherapy.*



## ADVANCED MATERIALS in MODERN MEDICINE

### 1. RECENT ADVANCES IN MULTICOMPONENT POLYMER SYSTEMS WITH CONTROLLED 3D ARCHITECTURES (conference)

Maria Valentina Dinu<sup>1</sup>, Maria Marinela Lazăr<sup>1</sup>, Irina Elena Rășchip<sup>1</sup>, Claudiu-Augustin Ghiorghiță<sup>1</sup>, Ioana Victoria Platon<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

#### Abstract

Multicomponent polymer systems with tuned 3D architectures have been prepared from synthetic, natural polymers or various combinations of them, and have been stabilized through physical or chemical cross-linking. The morphology of 3D architectures was controlled either by synthesis conditions for the hydrogel-type systems or by the intrinsic properties of the amphiphilic block copolymers used to prepare vesicles by self-assembly in aqueous media. The present talk aims to give an overview on (i) cross-linked polymer vesicles as protective compartments for enzymes functionality, packing polymers/hydrogels into enzyme-loaded polymersomes (nanoreactors) via biocatalytic atom transfer radical polymerization (ARGET-ATRP), and enzymatic catalysis into the confined space of nanoreactors, and (ii) cross-linked sponge-like cryogel architectures obtained by ice template-assisted freeze-drying as carriers for bioactive molecules (polyphenols, essential oils) to increase their stability, and bioavailability. The encapsulation of bioactive compounds endows the bio-based hydrogel-type systems with remarkable antioxidant and antimicrobial properties.

**Keywords:** *polymers, 3D architectures, hydrogels.*

### 2. SELF-ASSEMBLED VESICLES FROM ELECTROSPUN AMPHIPHILIC FIBERS (communication)

Maria Celina Sanchez Cerviño<sup>1</sup>, Guadalupe Rivero<sup>1</sup>

<sup>1</sup>Institute of Materials Science and Technology Research (INTEMA), Mar del Plata, Argentina

#### Abstract

Vesicles are supramolecular spherical structures with great potential as nanocarriers in drug delivery systems. While controlling the self-assembly vesicles formation processes used to be expensive and complex; we explored electrospun amphiphilic fibers as templates for the in situ formation of vesicles when sub-micrometric fibers are dissolved in water. Nanofabrication methods as electrospinning, pre-confines the hydrophilic and phospholipid components, thus tuning the molecular arrangement when fibers are dissolved. In this work, different fibers composed of polyvinylpyrrolidone K60 and soybean lecithin were electrospun in order to manipulate the molecular self-assembly for the synthesis of vesicles. The main objective is to correlate the characteristics of the formed vesicles with the morphological and compositional features of the precursor fibers and the involved processing parameters. Results showed that smaller vesicles were obtained from narrower fiber distributions. As the porosity of the sub-micrometric fibrous membranes increased, the polydispersity index of the vesicles was markedly decreased.

**Keywords:** *amphiphilic fibers, drug delivery systems, electrospun.*

### 3. DESIGNING NOVEL HYDROGELS BASED ON CHITOSAN-VITAMER TOWARDS BIOMEDICAL APPLICATIONS (communication)

Anda M. Craciun<sup>1</sup>, Liliana Mititelu-Tartau<sup>2</sup>, Luminita Marin<sup>1</sup>

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<sup>2</sup>"Grigore T. Popa" University of Medicine and Pharmacy Iași, Iași, Romania

#### **Abstract**

Hydrogels represent an important class of materials, obtained by crosslinking polymers into networks able to retain large amounts of water, and to be easily processed in a broad diversity of shapes. The hydrogel properties can be tuned by the nature of its components, the polymer and crosslinker. Aiming to design new hydrogels suitable for biomedical applications, this study was focused on the synthesis of new hydrogels starting from a biopolymer with impressive properties, chitosan, chemically crosslinked with a monoaldehyde, by a strategy developed within our laboratory. The choice of the aldehyde was based on the desire to obtain biocompatible and biodegradable materials, choosing therefore the biologically active form of vitamin B6, namely pyridoxal 5-phosphate. Due to this favorable association, the obtained hydrogels present microporous morphology, enzymatic biodegradability, good in vitro cytocompatibility and lack of damaging effect on experimental mice, being therefore suitable to be used in biomedical field.

**Keywords:** *chitosan-vitamer, hydrogels, crosslinker.*

#### **4. SURFACE WETTABILITY AND TOPOGRAPHY OF SOME THERMOSTABLE POLYMER FILMS FOR TARGETED APPLICATIONS (communication)**

*Simona Luminita Nica<sup>1</sup>, Raluca Marinica Albu<sup>1</sup>, Iuliana Stoica<sup>1</sup>, Luminita Ioana Buruiana<sup>1</sup>, Andreea Irina Barzic<sup>1</sup>*

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

#### **Abstract**

In the recent decades, polymer materials have been intensively introduced in the medical sciences and other technological areas. Such compounds have found applicability in manufacturing devices for diseases diagnosis or monitoring, medical equipment and implants. This work is focused on the assessment of the blood compatibility of a set of thermostable polymers with distinct structural features. It could be noted that the wettability of each sample dictates the adhesion capacity of the polymer surface towards certain cells or proteins found in the human blood fluid. The values of surface polarity and dispersive properties and their ratio are affecting the biocompatibility. Morphology of the analyzed polymers is tested by atomic force microscopy. These theoretical results are essential for the future design of polymers for future biomedical uses.

**Keywords:** *polymer, biomedicine, thermostable polymer films.*

#### **5. PREPARATION AND CHARACTERIZATION OF CS/PVA HYDROGELS CONTAINING IN SITU GENERATED SILVER NANOPARTICLES (communication)**

*Dana M. Suflet<sup>1</sup>, Marieta Fundueanu-Constantin<sup>1</sup>, Delia Mihaela Rata<sup>2</sup>*

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

<sup>2</sup>Faculty of Medical Dentistry, "Apollonia" University of Iasi, Iasi, Romania

#### **Abstract**

Recent investigations in the field of biomaterials have shown an increased interest in the prevention of bacterial infections. Treatment of infected skin wounds, oral or intestinal mucosal diseases could be ensured by the use of polysaccharide-based hydrogels with antimicrobial activity. Taking into account these aspects, the present work was focused on the preparation and characterization of stable CS/PVA-based hydrogels with enhanced antimicrobial activity, by the in situ generation of silver nanoparticles (AgNPs) under UV irradiation. The morphology of the hydrogels investigated by SEM microscopy, revealed the well-defined pores with 50 μm average diameter, and AgNPs with sizes between 88-400 nm. The cubic crystalline form of Ag was confirmed by XRD. The main characteristics of CS/PVA hydrogels: gel fraction, degree of swelling in pure water or phosphate buffers, as well as the elastic modulus were also studied. The CS/

PVA hydrogels entrapped with AgNPs exhibited high inhibitory activity against *S. aureus* and *K. pneumoniae*. The viability tests confirmed the lack of cytotoxicity of the obtained CS/PVA hydrogels.

**Acknowledgement:** This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P2-2.1-PED-2019-1780 within PNCDI III

**Keywords:** *CS/PVA hydrogels, silver nanoparticles, cytotoxicity.*

## 6. ADVANCED NANOCOMPOSITE POLYMER MATERIALS FOR ENERGY-EFFICIENT DYNAMIC SELF-THERMAL COMFORT (communication)

*George Stiubianu<sup>1</sup>, Cristian Ursu<sup>1</sup>, Mihaela Dascalu<sup>1</sup>, Alexandra Bargan<sup>1</sup>, Adrian Bele<sup>1</sup>, Codrin Tugui<sup>1</sup>, Carmen Racles<sup>1</sup>, Maria Cazacu<sup>1</sup>*

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

### Abstract

Efficient thermal management materials can provide thermal comfort and save energy when used for buildings and clothing. Using as bioinspiration the mirror spider (*Th. argentiopunctata*) which can dynamically shift its skin color and light reflectance we developed polymer nanocomposite materials with the desired characteristics of both passive and active heating systems. These newly developed materials are flexible, stretchable and surface conformable, have low weight and compact design, can be custom-made by scalable fabrication techniques (doctor blading, 3D printing) without the use of organic solvents. The tested nanocomposite materials can regulate a heat flux of 50 W/m<sup>2</sup> in the form of reflected/transmitted thermal infrared radiation, acting similarly to infrared radiation heating therapy. Thus, the nanocomposites are ideal materials for clothing that can dynamically control changes in the individual body temperature within a setpoint temperature range of 8 °C, which could lead to 3% energy savings of global commercial energy consumption.

**Keywords:** *polymers, nanocomposite materials, energy.*

## 7. SURFACE PROPERTIES OF PROTECTIVE FILM FOR ORAL DRUG DELIVERY DEVICES (conference)

*Maurice Brogly<sup>1</sup>, Sophie Bistac<sup>1</sup>*

<sup>1</sup>Laboratoire de Photochimie et d'Ingenierie Macromoleculaires, Universite de Haute Alsace, Mulhouse, France

### Abstract

Additives such as plasticizers, surfactants, lipids, colorants or other film-forming polymers are frequently incorporated into biopolymer matrices to produce high quality drug protective films. The aim of this work is to formulate biobased protective films by introducing polar and non-polar additives, and then to investigate their surface, adhesive and frictional properties at nanoscopic scale. The influence of additives on film structuration and morphology, permeation, hydrophilic/hydrophobic character as well as surface adhesion and friction are evaluated. The results clearly underline the strong dependence of film properties on additive nature, concentration or water sensitivity and the interplay with additive-biopolymer matrix compatibility.

**Keywords:** *polymers, oral drug delivery devices, drug protective films.*

## 8. PHYSICOCHEMICAL CHARACTERIZATION AND EVALUATION OF ANTIMICROBIAL ACTIVITY OF SILVER NANOPARTICLES ENCAPSULATED INTO CHITOSAN/PVA HYDROGELS (communication)

*Irina Popescu<sup>1</sup>, Marieta Constantin<sup>1</sup>, Irina M. Pelin<sup>1</sup>, Daniela L. Ichim<sup>2</sup>, Oana. M. Daraba<sup>2</sup>*

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

<sup>2</sup>Faculty of Medical Dentistry, "Apollonia" University of Iasi, Romania

**Abstract:**

Silver nanoparticles (AgNPs) with very small size (5-16 nm) were obtained using chitosan both as reducing agent and stabilizer. The AgNPs were entrapped into chitosan/PVA hydrogel obtained by freeze-thawing procedure of polymer solution containing oxalic acid. The mechanical properties of the hydrogel are deeply influenced by the amount of the ionic cross-linker (oxalic acid) and the degree of PVA crystallization. Preformed AgNPs, introduced in the polymer solution at desired concentrations, are uniform distributed in the polymeric matrix, as demonstrated by AAS and EDX analyzes. The swelling degree, mechanical properties and hydrolytic degradation rate of the hydrogel were influenced by the amount of dispersed AgNPs. The hydrogels with 0.3-1.2% AgNPs proved to have a good cytocompatibility and exercise antibacterial activity against *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Porphyromonas gingivalis*.

**Acknowledgment:** This work was supported by a grant of Romanian Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P2-2.1-PED-2019-1780 within PNCDI III.

**Keywords:** *hydrogels, antimicrobial activity, silver nanoparticles.*

**9. NEW PERFORMANCES OF BACTERIAL NANOCELLULOSE: GREEN SUPPORT FOR METALLIC NANOPARTICLES AND ENZYME IMMOBILIZATION** (communication)

*Marijana Ponjavic<sup>1</sup>, Sanja Stevanovic<sup>1</sup>, Sanja Jeremic<sup>2</sup>, Jasmina Nikodinovic-Runic<sup>2</sup>, Vladan R. Cosovic<sup>1</sup>*

<sup>1</sup>*Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Serbia*

<sup>2</sup>*Institute of Molecular Genetics and Genetic Engineering, University of Belgrade, Serbia*

**Abstract**

Bacterial nanocellulose, BNC, has emerged as a new class of nanomaterials recognized as renewable, biodegradable, biocompatible material of great research interest for versatile applications. Owing to its unique properties - morphology and surface chemistry, the high specific area, BNC appeared as perfect candidate for enzyme immobilization and metallic nanoparticle synthesis. Herein, microwave assisted synthesis of platinum nanoparticles catalyst on BNC as green supporting material has been reported for the first time. Bacterial nanocellulose-platinum catalyst was investigated by FTIR, DSC, AFM and TEM analysis, while its electrocatalytic performance was investigated for methanol oxidation. The obtained results confirmed successful synthesis of new Pt-based catalyst with remarkable catalytic activity. Additionally, bacterial laccases have been successfully immobilized on BNC via adsorption and activity of such obtained biocatalyst was assessed. Main advantage of enzyme immobilized on BNC was possibility of reuse, and in this study it was confirmed that biocatalyst retained significant activity after repeated.

**Keywords:** *Bacterial nanocellulose, metallic nanoparticles, enzyme immobilization.*

**10. STUDIES ON ANTIMICROBIAL AND ANTITUMORAL EFFECTS OF SELECTED MUSHROOMS GROWING IN ROMANIA** (communication)

*Daniela Zavastin<sup>1</sup>, Simona Gherman<sup>1</sup>, Cristina Tuchilus<sup>1</sup>, Alexandru Vasincu<sup>1</sup>, Anca Miron<sup>1</sup>*

<sup>1</sup>*"Grigore T. Popa" University of Medicine and Pharmacy, Faculty of Pharmacy*

**Abstract**

The study evaluated the antimicrobial and antitumoral effects of ethanolic extracts from the fruiting bodies of wild edible mushrooms *Armillaria mellea*, *Lactarius salmonicolor*, *Russula cyanoxantha*, *Russula mustelina*, *Russula xerampelina*. The antimicrobial effects against Gram-positive, Gram-negative and yeasts were assessed by agar diffusion assay. Among the extracts, there are those obtained from *Russula mustelina* and *Russula xerampelina* which demonstrated an antimicrobial activity comparable to that of chloramphenicol, both against *Staphylococcus aureus* (D = 20 mm and 20 mm vs. 20 mm), and against *Pregnancy lutea* (D = 25 mm and 25 mm vs. 25



mm). The antitumor activity was evaluated on five cell lines: MCF-7, A549, PC3, CACO-2 and MCF-12F using MTT method. The A549 line was the most sensitive to the action of *Russula cyanoxantha* extract (reduction of cell viability to  $63.83 \pm 1.54\%$  for the concentration of  $50 \mu\text{g} / \text{mL}$ ).

**Keywords:** *antimicrobial, antitumoral, mushrooms.*

#### 11. ANTIMICROBIAL ACTIVITY OF NYSTATIN-LOADED NANOPARTICLES OBTAINED FROM POLYESTERS-BASED BLOCK COPOLYMERS (communication)

Leonard I. Atanase<sup>1</sup>, Daniela L. Ichim<sup>1</sup>, Oana M. Daraba<sup>1</sup>, Anca N. Cadinoiu<sup>1</sup>, Delia M. Rata<sup>1</sup>, Oana Cucoveica<sup>1</sup>, Romain Triaud<sup>2</sup>, Christelle Delaite<sup>2</sup>

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##### Abstract

In the first step of this project, a series of biocompatible and biodegradable polyesters based on poly( $\epsilon$ -caprolactone)-*b*-poly(ethylene adipate)-*b*-poly( $\epsilon$ -caprolactone) (PCL-PEA-PCL) copolymers was synthesized, by melt polycondensation technique of  $\epsilon$ -CL starting from a dihydroxy-PEA, and characterized by a physicochemical point of view. These copolymers are the perfect candidates for the preparation of drug delivery systems (DDS) as they are biocompatible and biodegradable. Starting from these samples, Nystatin-loaded nanoparticles (NPs) were prepared by using the simplest technique, namely nanoprecipitation. Independent of the molecular weight of the copolymer samples, NPs with sized under 200 nm were obtained. The biological tests proved that these NPs are both hemo- and biocompatible. Moreover, they have a pronounced antifungal activity on different strains of *Candida*.

**Acknowledgement:** This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2019-0664, within PNCDI-III.

**Keywords:** *antimicrobial activity, Nystatin-loaded nanoparticles, block copolymers.*

#### 12. SILVER-BASED SILICA HYBRID FILMS: SYNTHESIS, CHARACTERIZATION, AND ANTIMICROBIAL ACTIVITY (communication)

Violeta Purcar<sup>1</sup>, Valentin Rădițoiu<sup>1</sup>, Alina Rădițoiu<sup>1</sup>, Florentina Monica Raduly<sup>1</sup>, Mariana Constantin<sup>1,2</sup>, Cristina Firincă<sup>1</sup>, Raluca Șomoghi<sup>1,3</sup>, Mihai Anastasescu<sup>4</sup>, Simona Căprărescu<sup>5</sup>

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<sup>5</sup>University Polytechnic of Bucharest, Faculty of Applied Chemistry and Materials Science, Department of Inorganic Chemistry, Physical Chemistry and Electrochemistry, Bucharest, Romania

##### Abstract

The aim of this work was to achieve the hybrid films through the deposition of silver-based silica materials on glass surfaces. These materials were synthesized by the sol-gel method in acidic conditions, using different silane precursors. The  $\text{AgNO}_3$  solution was used as a source of  $\text{Ag}^+$  ions. The final samples were analysed by TEM and AFM microscopy, and UV-Vis spectroscopy. The antimicrobial activity of obtained samples was investigated by the diffusion method through spot inoculation, against *Staphylococcus aureus* and *Candida albicans*. The TEM and AFM images confirm that the silver nanoparticles have been attached on the silica surface and were found to be around 3 nm. UV-Vis spectra indicated that the hybrid films have a transmittance of  $\sim 92\%$ , at 550 nm. Silver-based silica material

posses antimicrobial ability against fungal and bacterial strains compared with silica material. The final results demonstrated that the prepared materials have antimicrobial activity and anti-reflective effect.

**Acknowledgements:** The work on this paper was supported by the INCDCP ICECHIM Bucharest 2019-2022 Core Program PN. 19.23-Chem-Ergent, Project No.19.23.03.04.

**Keywords:** *antimicrobial activity, Nystatin-loaded nanoparticles, block copolymers.*

### 13. CHITOSAN-BASED HYDROGELS AND ORGANOGELS AS BIOACTIVE MATERIALS (conference)

*Elena Stoleru<sup>1</sup>, Daniela Pamfil<sup>1</sup>, Raluca P. Dumitriu<sup>1</sup>, Mihai Brebu<sup>1</sup>*

*<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

#### **Abstract**

The increasing prevalence of microbial infections, especially those associated with impaired wound healing and biomedical implant failure, and the rapid emergence of antibiotic resistance in pathogenic microbes has spurred the development of new materials having antimicrobial activity. Hydrogels offer a useful starting point to engineer antimicrobial materials. Chitosan is increasingly used in pharmaceutical and tissue engineering applications presenting biocompatibility and moderate antimicrobial activity. Our current research aims the development of chitosan-based materials with tailored functionalities, such as antimicrobial/antioxidant activity and biodegradability. Comparative results regarding the synthesis and properties evaluation of various chitosan-based materials will be presented. The obtaining methods of chitosan hydrogels or organogels involved various cross-linking approaches (chemical, ionic, UV or ultrasound assisted). The synthesized hydrogels and organogels present various beneficial properties such as antioxidant, antimicrobial, biocompatibility for tissue engineering and wound healing applications.

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**Keywords:** *Chitosan, hydrogels, organogels.*

### 14. CHITOSAN BASED NANOFIBERS FOR WOUND DRESSING APPLICATIONS (communication)

*Alexandru Anisie<sup>1</sup>, Bianca-Iustina Andreica<sup>1</sup>, Luminita Marin<sup>1</sup>*

*<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

#### **Abstract**

Electrospinning is a progressive method that produces fibers ranging from the submicron level to several nanometers in diameter in a high voltage electrostatic field. This is a relatively old approach to fiber spinning but it is currently one of the most advanced methods in manufacturing high-performance nanofibers. Among them, those based on chitosan keep the promise for biomedical applications, especially for tissue engineering and wound dressings. In this light, the study presents new hybrid fibers composed from chitosan (Ch) and quaternary ammonium salts of chitosan (QC), designed to attain bandages with improved antimicrobial activity, biodegradation rate and mucoadhesivity. They were prepared by electrospinning Ch/QC/PEG in different mass ratios, followed by PEG removal. The fibers were investigated to establish their morphology, swelling ability, dissolution rate, antimicrobial activity and in vitro and in vivo biocompatibility. The results suggest that these new materials are suitable for application as resorbable bandages for wound healing.

**Keywords:** *chitosan, nanofibers, wound dressing.*

**15. SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL ACTIVITY OF PULLULAN - PVA HYDROGELS LOADED WITH CALENDULA OFFICINALIS EXTRACT** (communication)

*Irina Mihaela Pelin<sup>1</sup>, Irina Popescu<sup>1</sup>, Daniela L. Ichim<sup>2</sup>, Marieta Constantin<sup>1</sup>, Gheorghe Fundueanu<sup>1</sup>*

<sup>1</sup>*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

<sup>2</sup>*Faculty of Medical Dentistry, "Apollonia" University of Iasi, Romania*

**Abstract**

Herbal aqueous extracts usually show drawbacks, such as long term volatility, poor bioavailability and rapid burst release. In this study, hydrogels based on pullulan (P) and poly(vinyl alcohol) (PVA) were prepared by dual cross-linking (simultaneously chemical cross-linking with sodium trimetaphosphate and physical cross-linking by freeze-thaw technique), then post - loaded with *Calendula officinalis* flowers extract. The plant extract showed great antioxidant capacity of 93.84 mg/mL, due to high content of total phenolic compounds (375.67 GA mg/g). The hydrogels were characterized in terms of morphology, swelling ratio and mechanical properties, as well as antioxidant and antimicrobial activities. Active substance contained in P-PVA hydrogels was released much faster in phosphate buffer at pH 7.4 than at pH 5. Plant extract conferred significant antibacterial effects toward *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Escherichia coli* as well as strong antioxidant activity against DPPH. The antioxidant and antibacterial activities recommends these hydrogels as dressing materials for skin wound healing.

**Acknowledgment:** This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0050 within PNCDI III.

**Keywords:** *biological activity, Pullulan - PVA hydrogels, Calendula officinalis extract.*

**16. FABRICATION OF CHITOSAN BASED HYDROGELS CROSS LINKED BY APTES AND ITS BIOLOGICAL TESTING IN CHICK AND MOUSE MODELS** (communication)

*Atif Islam<sup>1</sup>, Sehrish Jabeen<sup>1</sup>, Chaman Ara<sup>2</sup>, Ariba Farooq<sup>3</sup>, Tabinda Riaz<sup>1</sup>, Nafisa Gull<sup>1</sup>, Shahzad Maqsood Khan<sup>1</sup>, Rafi Ullah Khan<sup>1</sup>*

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<sup>3</sup>*Department of Chemistry, University of the Punjab, Lahore, Pakistan*

**Abstract**

For complete wound healing, rapid activation of angiogenesis is important as it helps in formation of new blood vessels, supply of oxygen and nutrients to wound area. Current study aim to assess chorioallantoic membrane (CAM) assay on chick model and to evaluate healing efficacy of hydrogels made of chitosan, poly vinyl alcohol and crosslinked with different concentration of amino silanes as cross linker. The hydrogels were characterized by SEM, TGA, and FTIR. CAM assay was performed to study angiogenesis and morphological analysis by implanting hydrogels on chorioallantoic membranes of developing chicks and for wound healing, a full thickness 6mm wound was created on dorsolateral skin of mice. Fertilized eggs with implanted hydrogels showed high number of blood vessels, similarly, complete wound healing with excellent reduction in wound size, epithelialization, and collagen formation was observed. The multifaceted hydrogels would be an excellent candidate to promote angiogenesis and effective wound healing.

**Keywords:** *chitosan, hydrogels, chick models, mouse models.*

**17. DEVELOPMENT OF BIOMATERIALS BASED ON QUATERNIZED CHITOSAN**

*Bianca-Iustina Andreica<sup>1</sup>, Irina Rosca<sup>1</sup>, Luminita Marin<sup>1</sup>*

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

### Abstract

Hydrogels are defined as hydrophilic polymer chains crosslinked via chemical or physical linkages, leading to three-dimensional networks able to retain great volumes of water or of biological fluids. The class of polymers suitable for hydrogelation is vast, among which chitosan plays an important part, due to its remarkable biological properties and, moreover, it represents a sustainable choice because it is extracted from renewable resources. In line with these, the study presents the synthesis and characterization of hydrogels based on a quaternary ammonium salt of chitosan crosslinked with a natural originating monoaldehyde. This chitosan derivative was chosen due to its solubility over a wide pH range, and its notable biological properties. The series of hydrogels was completely characterized from the structural and morphological point of view. Moreover, their biodegradability, biocompatibility as well as their antimicrobial activity was also evaluated, proving that these materials can be proposed for biomedical applications.

**Keywords:** *biomaterials, hydrogels, quaternized chitosan.*

### 18. POLYELECTROLYTES AS BUILDING STONES: CREATING NANOPARTICLES IN AQUEOUS SOLUTIONS BY ELECTROSTATIC CO-ASSEMBLY (conference)

Miroslav Štěpánek<sup>1</sup>

<sup>1</sup>Charles University, Faculty of Science, Prague, Czech Republic

### Abstract

Polyelectrolytes are known to form complexes with oppositely charged multivalent ions, such as oppositely charged polyelectrolytes (so called interpolyelectrolyte complexes, IPEC) or micelles of oppositely charged ionic surfactants (so called polyelectrolyte surfactant complexes, PES). While polyelectrolytes and ionic surfactants are water-soluble, IPEC and PES tend to form water-insoluble solids or liquids. When using hydrophilic block copolymers with polyelectrolyte blocks forming IPEC or PES can lead to co-assembled core-corona nanoparticles with insoluble IPEC or PES cores. In this lecture, we will discuss properties of electrostatic co-assemblies of block polyelectrolytes and their potential applications for encapsulation of ionic species.

**Keywords:** *polyelectrolytes, nanoparticles, electrostatic co-assembly.*

### 19. MAGNETIC CATIONIC LIPOSOMES FOR THE TREATMENT OF INFLAMMATORY DISEASES (communication)

Anca N. Cadinoiu<sup>1</sup>, Delia M. Rata<sup>1</sup>, Leonard I. Atanase<sup>1</sup>, Gabriela Mihalache<sup>1</sup>, Marcel Popa<sup>1,2</sup>

<sup>1</sup>Faculty of Medical Dentistry, "Apollonia" University of Iasi, Iasi, Romania

<sup>2</sup>Academy of Romanian Scientists, Bucharest, Romania

### Abstract

The aim of this work was to prepare and characterize magnetic cationic liposomes loaded with dexamethasone as a DDS for the administration of anti-inflammatory drugs. Liposomes were prepared from egg yolk phosphatidylcholine, DOTAP and cholesterol in various molar ratios using the film hydration method. Magnetic nanoparticles were embedded in both the aqueous core and the lipid membrane. The model drug, dexamethasone, was loaded into the aqueous core of liposomes. The average size and zeta potential of the magnetic cationic liposomes obtained were measured using the Dynamic Light Scattering technique. Morphological differences between empty and drug-loaded liposomes were observed by transmission electron microscopy (TEM). The loading efficiency of the drug, the stability and the in vitro drug release were evaluated by UV-Vis spectroscopy. The obtained results encourage us to continue testing to demonstrate the



effectiveness of magnetic cationic liposomes loaded with dexamethasone in the treatment of inflammatory diseases.

**Acknowledgement:** „The research leading to these results has received funding from the NO Grants 2014-2021, under Project contract no. 15 / 2020”.

**Keywords:** *Magnetic cationic liposomes, inflammatory diseases, polymers.*

## **20. CORE-SHELL POLYELECTROLYTE COMPOSITES WITH VERSATILE PROPERTIES IN POLLUTANTS REMOVAL FROM CONTAMINATED WATERS (communication)**

*Florin Bucatariu<sup>1</sup>, Larisa-Maria Petrila<sup>1</sup>, Marius-Mihai Zaharia<sup>1</sup>, Marcela Mihai<sup>1</sup>*

*<sup>1</sup>“Petru Poni” Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

Inorganic/organic composites based on polyelectrolytes could be used in multiple sorption/desorption cycles of different types of pollutants dissolved in waste and surface waters. Using different deposition strategies (layer-by-layer, precipitation) of polyelectrolyte chains onto SiO<sub>2</sub> cores (natural and synthetic), followed by chemical cross-linking it was successfully synthesized core-shell composites with accessible and high number of functional groups on solid surface. The batch and column sorption studies of organic/inorganic pollutants demonstrated the versatility of this type of substrates in water cleaning.

**Acknowledgements:** This work was supported by a grant of Romanian Ministry of Education and Research, CCCDI-UEFISCDI, project number PN-III-P2-2.1-PED-2019-1996, within PNCDI III.

**Keywords:** *core-shell polyelectrolyte composites, pollutants removal, contaminated waters.*

## **21. PREPARATION OF COMPOSITE MICROPARTICLES COMPRISED OF SILICA/POLYETHYLENIMINE CORE AND POLYSACCHARIDE-BASED LBL SHELLS AND THEIR POTENTIAL APPLICATIONS IN DELIVERY OF DRUGS (communication)**

*Claudiu-Augustin Ghiorghiță<sup>1</sup>, Ecaterina Stela Drăgan<sup>1</sup>, Maria Valentina Dinu<sup>1</sup>*

*<sup>1</sup>“Petru Poni” Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

In this work, new composite microparticles comprised of cross-linked PEI networks entrapped in the pores of silica microparticles and chitosan/carboxymethyl cellulose LbL thin films as pH-responsive biocompatible shells have been prepared. The construction of the composites was followed by FTIR spectroscopy, SEM, EDX, TGA, BET isotherms and potentiometric/polyelectrolytic titrations. The potential application of the novel composites as drug delivery systems was investigated using diclofenac sodium (DS) as model compound. The composites had a high loading capacity for DS and presented a prolonged drug release up to 170 h, thus supporting their potential use in the sustained release of bioactive compounds. The release mechanism was analyzed by fitting the experimental DS release data with the Higuchi, Korsmeyer-Peppas, Zero-order and First-order models.

**Keywords:** *composite microparticles, silica/polyethyleneimine core, polysaccharide-based LbL shells, delivery of drugs.*

## **22. ENZYME-ACTIVATABLE NANOPLATFORMS BASED ON PEG-GRAFTED II-CONJUGATED AMPHIPHILIC COPOLYMERS DESIGNED FOR SYNERGISTIC CANCER DIAGNOSIS AND DUAL-MODE PHOTODYNAMIC AND CHEMOTHERAPY (communication)**

*Anca-Dana Bendrea<sup>1</sup>, Luminita Cianga<sup>1</sup>, Gabriela-Elena Hitruc<sup>1</sup>, Irina Popescu<sup>1</sup>, Ioan Cianga<sup>1</sup>*

*<sup>1</sup>“Petru Poni” Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

The nanomedicines concomitantly allowing for early diagnosis, for various types of therapies and real-time monitoring of the therapeutic effect are ones of the most desired tools to be used in the fight with cancer. Recently it has been shown that amphiphilic grafted  $\pi$ -conjugated polymers (AGCPs) can be optimal candidates for diagnosis, drug delivery and combinatorial therapies due to their particular architecture and based on the CPs fluorescence and redox properties. Herein we report about new water-self dispersible AGCPs, able to form micellar nanoparticles with an enhanced stability, designed to preferentially accumulate at the tumor site via EPR effect due to the biomimetic PEG presence. After structural, photophysical and morphological characterization, the optimal variant from the copolymers, having the smallest size and with the highest fluorescence intensity, was used for the encapsulation of drug doxorubicin (DOX). Further, *in vitro* studies confirmed the capability of the obtained nanoplatfrom to deliver the cargo by endogenous carboxylesterase-triggered micelles disintegration.

#### **Acknowledgements**

This work was jointly supported by Romanian Academy and by Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0050, within PNCDI III.

**Keywords:** *enzyme-activatable nanoplatforms, PEG-grafted  $\pi$ -conjugated amphiphilic copolymers, cancer diagnosis.*

### **23. COMPUTER VISION APPLICATIONS IN THE ANALYSIS OF DRUG-LOADED MICROPARTICLES** (communication)

Monica Iliuta Cretan Stamate<sup>1</sup>, Ciprian Stamate<sup>2</sup>, Carmen Gafitanu<sup>1</sup>, Lacramioara Ochiuz<sup>1</sup>

<sup>1</sup>Faculty of Pharmacy, "Gr. T. Popa" University of Medicine and Pharmacy, Iasi, Romania,

<sup>2</sup>Mechanical Faculty, "Gheorghe Asachi" Technical University, Iasi, Romania

#### **Abstract**

Micrometer – sized particles are present in many different pharmaceutical forms like suspension, capsules and compressed tablets. The characterization of microparticles involves the exploration of structures at the microscale. Dimensional analysis of the microparticles detected in an image is very important when they play the role of anchor space for other structures. Ketoprofen surfaces microparticles are coated with cyclodextrin by complexation method in order to improve their properties and compatibility with the human body. When a surface is too smooth it shows a minimal roughness and cannot fix on it other structures. If on a surface are recorded agglomerations and unevenness too high then it is liable to pronounced wear in contact with other surfaces. SEM images present the topography of microparticles investigated and can be processed easily by IMAQ Vision. This program includes a set of optimized functions for image processing and particles analysis (size and shape).

**Keywords:** *ketoprofen, cyclodextrin, drug-loaded microparticles.*

### **24. STRATEGIES FOR TUNING PORE SIZE IN ELECTROSPUN SCAFFOLDS FOR TISSUE ENGINEERING APPLICATIONS** (communication)

Silvestre Bongiovanni Abel<sup>1</sup>, Gustavo A. Abraham<sup>1</sup>

<sup>1</sup>Institute of Materials Science and Technology Research (INTEMA), Mar del Plata, Argentina

#### **Abstract**

In recent years, electrohydrodynamic techniques (EHD) have gained considerable attention mainly triggered by the potential applications in bio/nanotechnology. Electrospun scaffolds provide a very suitable platform to develop innovative scaffolds for applications in the biomedical field such as hard and soft tissue engineering, wound healing, and drug delivery systems. However, electrospun scaffolds present a dense packing of fibers that reduces cell

infiltration and therefore lead in some cases to suboptimal cell response. By any modification in the process setup, any enhancement in the scaffold porosity would enrich cell infiltration and subsequent cell-to-cell and cell-to-matrix interactions leading to better and optimal cell response.

Our research group focuses its efforts on the design, preparation, characterization, and processing of polymeric/composite nanofibrous scaffolds obtained by EHD and combined techniques. In this presentation, a short overview of the strategies for tuning and enhancing pore size in electrospun scaffolds is presented. In addition, some experimental results related to this topic and current challenges are outlined.

**Keywords:** *pore size, electrospun scaffolds, tissue engineering applications.*

## **25. DEGRADABLE HYDROGELS FOR DRUG DELIVERY APPLICATIONS BASED ON POLY(2-ISOPROPENYL-2-OXAZOLINE)** (communication)

*Emilian Ghibu<sup>1</sup>, Nicoleta Doriană Banu<sup>1</sup>, Diana Giol<sup>1</sup>, Valentin Victor Jerca<sup>1</sup>, Florica Adriana Jerca<sup>1</sup>*

<sup>1</sup>*Centre of Organic Chemistry "C.D. Nenitescu", Romanian Academy, Bucharest, Romania*

### **Abstract**

Hydrogels are versatile materials with a wide range of applicability in agriculture, hygiene products and biomedicine. Poly(2-isopropenyl-2-oxazoline) (PiPOx) is a polymer that has recently emerged as a suitable platform for the development of synthetic hydrogel materials due to its interesting properties such as water-solubility, biocompatibility, non-toxic and non-immunogenic response, and versatile post-polymerization modification reaction with di(carboxylic) acids. The present study highlights the use of PiPOx, as biocompatible functional polymer to develop synthetic degradable hydrogel materials for drug delivery applications.

**Keywords:** *hydrogels, drug delivery, poly(2-isopropenyl-2-oxazoline).*

## **26. DEVELOPMENT OF A MESOPOROUS SILICA SYSTEMS LOADED WITH METFORMINE HYDROCHLORIDE** (communication)

*Sha'at Mousa<sup>1</sup>, Ignat Maria<sup>2,3</sup>, Bujor Alexandra<sup>1</sup>, Stamate Monica - Iliuța<sup>1</sup>, Ștefanache Alina<sup>1</sup>, Șpac Adrian Florin<sup>1</sup>, Ochiuz Lăcrămioara<sup>1\*</sup>*

<sup>1</sup>*Faculty of Pharmacy, "Grigore T. Popa" University of Medicine and Pharmacy Iași, Iași, Romania*

<sup>2</sup>*Department of Chemistry, "Alexandru Ioan Cuza" University from Iasi, Iasi, Romania*

<sup>3</sup>*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

The aim of the present study is to incorporate metformine hydrochloride (MTF) into the pores of mesoporous silica nanoparticles. The development of this inorganic delivery system is designed for oral dosage forms that are able to improve the bioavailability of the active ingredient. Two types of mesoporous silica matrix (SBA-15 and KIT-6) were synthesized by ultrasound process using Sonics Vibra Cell TM Model CV 33 (ultrasonic generator) operating in a pulse mode (3/1 sec. on/off cycle) for 2 hours, then the white solid product was calcined 550 °C for 6 hours with a rate of temperature increase of 1 °C/min to create porosity. The textural characterization of the silica systems was obtained with BET (Brunauer-Emmett-Teller) surface area analysis, while the quantity of MTF loaded in the nanoporous matrix was determined by HPLC method - retention time (RT) = 5.246 min. Textural parameters were determined from nitrogen sorption isotherms (recorded on a Quantachrome Nova 2200 Instrument). The development of new delivery systems of mesoporous silicate with MTF leads to the optimization of the biopharmaceutical properties of the drug to maximize its potential benefits.

**Acknowledgements:** The work on this paper was financed by the "Grigore T. Popa" University of Medicine and Pharmacy Iași, Romania, Grant No. 10307/29.06.2020.

**Keywords:** *mesoporous silica systems, metformine hydrochloride, biopharmaceutical.*

## **27. SYNTHESIS AND CHARACTERIZATION OF COMPOSITE CRYOGELS BASED ON POLYACRYLAMIDE AND POLY(N,N -DIMETHYLAMINOETHYL METHACRYLATE) WITH POTENTIAL IN DELIVERY OF CURCUMIN (communication)**

*Maria Marinela Lazăr<sup>1</sup>, Ecaterina Stela Drăgan<sup>1</sup>, Claudiu Augustin Ghiorghită<sup>1</sup>, Maria Valentina Dinu<sup>1</sup>*  
<sup>1</sup>*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

The main goal of this work was the preparation of novel drug delivery systems for sustained release of a natural hydrophobic polyphenol (curcumin). In this regard, semi-interpenetrating polymer networks (s-IPNs) based on poly(N,N-dimethylaminoethyl methacrylate) (PDMAEMA) entrapped in poly(acrylamide) networks, by a cryogelation technique, were developed. All s-IPN cryogels were characterized by SEM, EDX, FTIR, and swelling at equilibrium as a function of pH. Functionalization of s-IPN cryogels with monochlorotriazinyl- $\beta$ -cyclodextrin led to IPN cryogels. The release profile of curcumin from the composite cryogels was investigated at 37 °C, in pH 3. It was found that the cumulative release increased with the increase of the carrier hydrophobicity, as a result of increasing the cross-linking degree, the content and the molar mass of PDMAEMA. Fitting Higuchi, Korsmeyer-Peppas, and first order kinetic models on the curcumin release profiles indicated the diffusion as the main driving force of drug release from the composite.

**Keywords:** *composite cryogels, polyacrylamide, curcumin.*

## **28. OH TYPE INFLUENCED CROSSLINKING FOR THE CONTROL OF SWELLING PROPERTIES IN CD-PEG POLYURETHANE NETWORKS (communication)**

*Alexandra-Diana Diaconu<sup>1</sup>, Maricel Danu<sup>2</sup>, Valeria Harabagiu<sup>1</sup>, Cristian Peptu<sup>1</sup>*

<sup>1</sup> *"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

<sup>2</sup> *"Cristofor Simionescu" Faculty of Chemical Engineering and Protection of the Environment, „Gheorghe Asachi" Technical University, Iasi, Romania*

### **Abstract**

Cyclodextrin-poly(ethylene glycol) (CD-PEG) polyurethane networks, obtained through the crosslinking reaction between poly(ethylene glycol) (PEG) modified at both ends with isophorone diisocyanate (IPDI) and various types of cyclodextrins, were employed to determine the influence of the hydroxyl type, primary or secondary, on the properties of the resulting hydrogels. Thus, gelation kinetics and swelling properties were taken into consideration for the hydrogels evaluation. In the synthesis of polyurethane systems were used:  $\beta$ -cyclodextrin (CD) - 7 primary hydroxyl groups and 14 secondary hydroxyl groups,  $\beta$ -cyclodextrin modified with D,L-lactide (CDLA) - mainly secondary hydroxyl groups and  $\beta$ -cyclodextrin modified with  $\epsilon$ -caprolactone (CDCL) - number of primary hydroxyl groups higher than  $\beta$ -CD. FT-IR structural characterization, rheological gelation kinetics and water swelling properties were correlated with the starting CD type.

**Keywords:** *crosslinking, swelling properties, CD-PEG polyurethane networks.*

## **29. BILE SALTS ADSORPTION ON DEXTRAN-BASED HYDROGELS (communication)**

*Magdalena Cristina Stanciu<sup>1</sup>, Marieta Nichifor<sup>1</sup>*

<sup>1</sup>*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

### **Abstract**

Dextran-based gels bearing two types of pendant N,N-dimethyl-N-alkyl-N-(2-hydroxypropyl) ammonium chloride groups with different alkyl chain length substituents ( $C_2$  and  $C_{12}/C_{16}$ )



respectively) at the quaternary nitrogen were synthesized and characterized. The morphology and size of polymeric microspheres were examined by SEM and their swelling behavior in water was also investigated. The hydrogels were evaluated as sorbents for sodium cholate and sodium deoxycholate in water and 10 mM NaCl solutions. Different isotherm models (nearest-neighbor-interaction, Langmuir, Freundlich, Dubinin-Raduskevich, Sips and Hill) were used to elucidate the adsorption mechanism and established the characteristics of the most efficient polymeric sorbent. Swelling porosity, ionic strength and ligand lipophilicity were other factors that also affected the adsorption process. The hydrogel having 25 mol% pendant dodecyl groups retained the maximum amount of bile salts (1051 mg NaCA/g and 1138 mg NaDCA/g). All hydrophobically modified hydrogels revealed a better affinity and strength of binding compared to commercial Cholestyramine®.

**Keywords:** *Bile salts adsorption, dextran-based hydrogels, Cholestyramine®.*

### 30. GLYCEROL AND GLYCEROL DERIVATIVES FOR THE DESIGN OF ADVANCED MATERIALS IN MEDICAL APPLICATIONS (conference)

*Amina Bedaidia<sup>1</sup>, A. Fabian<sup>1</sup>, R. Jagu<sup>1</sup>, Fanny Coumes<sup>1</sup>, Jean-François Rumigny<sup>1</sup>, Sophie Bistac<sup>1</sup>, Jean-François Stumbé<sup>1</sup>*

<sup>1</sup>*Laboratory of Macromolecular and Photochemical Engineering (LPIM), University of Haute Alsace, Mulhouse, France*

#### **Abstract**

In this paper, we first present the potential of using glycerol and some derivatives such as diglycerol and triglycerol as plasticizing agents for chitosan. In this respect, we were able to evidence the significant influence of the molecular weight of various chitosan grades as well as the influence of the nature and of the mass fraction of the selected plasticizers. These influences will be illustrated by the investigation of the mechanical properties of solvent casted chitosan films. In a second part, we will present some recent results in the implementation of functionalized hyperbranched polyglycerols for the design of new hydrogels used for the manufacture of transparent contact lenses. Two chemical routes based on a conventional radical polymerization route and on a polyurethane route to obtain such polymeric materials will be presented.

**Keywords:** *glycerol, chitosan, medical applications.*

### 31. NEW PEGYLATED PHENOTHIAZINE DERIVATIVES WITH TUMOR GROWTH INHIBITION PROPERTIES (communication)

*Sandu Cibotaru<sup>1</sup>, V. Nastasa<sup>2</sup>, A. I. Sandu<sup>1</sup>, A. C. Bostanaru<sup>2</sup>, Mihai Mares<sup>2</sup>, Luminita Marin<sup>1</sup>*

<sup>1</sup>*"Petru Poni" Institute of Macromolecular Chemistry of Romanian Academy, Iasi, Romania*

<sup>2</sup>*"Ion Ionescu de la Brad" University of Life Sciences, Iasi, Romania*

#### **Abstract**

This work reports the synthesis of new PEGylated phenothiazine derivatives in order to obtain water-soluble compounds with antitumor activity. Three different PEGylated compounds were synthesized by coupling a poly(ethylene glycol) chain to the phenothiazine core via three different linking groups (ether, ester, and amide). Their structure was confirmed by FTIR and NMR spectroscopy, and the ability to form aggregates was assessed by DLS and UV-vis techniques, and also by fluorescence spectroscopy, SEM, AFM, POM, and UV light microscopy. To prove the compound's biological application, their biocompatibility and antitumor activity were tested *in vitro* on fibroblasts and five human cancer cell lines. Two of the synthesized compounds presented a good *in vitro* cytotoxicity on cancer cells and consequently, they were further tested *in vivo* on mice, when demonstrated a diminished LD50 compared to pristine phenothiazine and high tumor

inhibition (92%). These results are encouraging future studies to improve the design towards more potent properties.

**Keywords:** *PEGylated phenothiazine, antitumor activity, cytotoxicity.*

### **32. POLYMER AND TEXTILES: EMERGING BIOLOGIZATION MATERIALS FOR MEDICAL TECHNOLOGIES** (communication)

*Shazhad Maqsood Khan<sup>1</sup>, Tabinda Riaz<sup>1</sup>, Nafisa Gull<sup>1</sup>, Saba Zia<sup>1</sup>*

*<sup>1</sup>Institute of Polymer and Textile Engineering, University of the Punjab Lahore, Pakistan*

#### **Abstract**

"Biologization" of medical technology is an important future requirement which require basic understanding of dead and living matter and of relation between them. This technological understanding can range from generation of simple molecules to three-dimensional structures. Enormous progress is required towards bioactive or even implant material developments for formation of soft and hard tissue replacement and medicine production. As trends to use polymers for preservative and health care medicines has increased, the hook up of polymers and textiles is also gaining interest in medical field day by day. Polymers with fibers in composite form or in polymer optical fibers form are gaining attention in health care practices successfully. Due to presence of both properties of fiber-optic functionalities & traditional fabric-like comfort, these textile-integrated polymer optical fibers have lessened or even removed several hurdles for long-term uninterrupted health monitoring and even treatment. This issue has a specific focus on polymer and textile engineering technologies use for biomedical applications. Tissues, muscles, tendons have biomechanical properties, and are often defined by fibers like collagen or elastin having high tensile strength and other mechanical properties with biological attentions. This tensile strength can enable to design and synthesize fiber materials coated with polymers to enable the production of load-oriented, anisotropic tissues. Polymers can independently or with textile products are used for production of regenerative medicines, bandages and controlled drug delivery modes.

**Keywords:** *polymers, textiles, medical technologies.*

### **33. COPPER COMPLEXES CONTAINING SCHIFF BASE LIGANDS-BIOLOGICAL ACTIVITIES** (communication)

*Alina Soroceanu<sup>1</sup>*

*<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

#### **Abstract**

Mononuclear copper (II) complexes CuL1, CuL2, CuL4 and CuL5 were synthesized either by template method when both ligand formation and its complexation occur in a single step, in the presence of the metal provider or by the complexation reaction of the presynthesized ligand with metal salt. The redox activity of the complexes induced by the presence of the azomethine group and transition metal was studied by cyclic voltammetry in DMF solution and compared with that of the corresponding ligands. Antimicrobial activity of the copper complexes derived from siloxane ligands was evaluated against three fungi (*Aspergillus flavus* ATCC 20046, *Penicillium chrysogenum* ATCC 20044, *Alternaria alternate* ATCC 8741) and two bacteria (*Pseudomonas aeruginosa* ATCC 27813 and *Bacillus sp.* ATCC 31073 species).

**Keywords:** *copper complexes, Schiff base, antimicrobial activity.*

### **34. BIOACTIVE AND BIODEGRADABLE SILATRANES AS POTENTIAL FUNCTIONAL ENTITIES FOR NANOPLATFOMRS OF BIOMEDICAL RELEVANCE** (communication)

Mirela-Fernanda Zaltariov<sup>1</sup>, Alexandra Bargan<sup>1</sup>, Dragos Peptanariu<sup>1</sup>, Cornel Cojocaru<sup>1</sup>, Bianca-Iulia Ciubotaru<sup>1</sup>, Maria Cazacu<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

#### Abstract

The class of hypervalent silicone derivatives, also known as silatranes, has been extensively developed mainly due to their potential application in medical field, proving some interesting pharmacological properties (anticancer, antimicrobial, anti-inflammatory, etc). Inspired by their biological activity and hydrolytic stability, we have prepared new silatranes derivatives by chemical transformations of an amino pentacoordinated silicon precursor by condensation with different carbonylic compounds. We evaluated their antimicrobial, hydrolytic stability in biological media, biocompatibility and antitumor activity, as well as their ability to bind protein/enzymes considered target in antitumor/antiviral therapy.

**Keywords:** *silatranes, nanoplatforms, biomedicine.*

### 35. INFLUENCE OF ZINC OXIDE NANOPARTICLES CONTENT ON MORPHOLOGY AND PROPERTIES OF POLY(3-HYDROXYBUTYRATE-CO-3-HYDROXYHEXANOATE) BIONANOCOMPOSITES (communication)

Nadjet Dehouche<sup>1</sup>, Mustapha Kaci<sup>1</sup>, Ismail Berrabah<sup>1</sup>, Stéphane Bruzaud<sup>2</sup>, Charles Henry Deguines<sup>3</sup>, Christelle Delaite<sup>3</sup>

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<sup>3</sup>LPIM, University of Haute Alsace, Mulhouse, France

#### Abstract

The paper describes the effect of ZnO-NP nanoparticles content on morphology and properties of bionanocomposites based on poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) (PHBHHx) intended for biomedical applications. The samples were prepared by melt compounding at 1.5, 3 and 6 wt.% filler content. Morphological observations by SEM of the cryo-fractured surface of the bionanocomposites showed that ZnO-NP were randomly dispersed in PHBHHx matrix, with however a noticeable presence of filler aggregates at 6 wt.%. XRD patterns displayed an increase in crystallinity of PHBHHx bionanocomposites with increasing ZnO-NP content, whereas TGA data indicated a decrease in the onset degradation temperature compared with PHBHHx.

**Keywords:** *zinc oxide nanoparticles, PHBHHx, bionanocomposites.*

### 36. PROMISING ALTERNATIVES TO SYNTHETIC-BASED PLASTICS FOR FOOD PACKAGING APPLICATIONS (conference)

Irina Elena Raschip<sup>1</sup>, Nicusor Fifere<sup>1</sup>, Maria Valentina Dinu<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

#### Abstract

Green chemistry and the harmonious development of the society are modern concepts that must guide the implementation of new products and processes in practice. Packaging materials play an important role in protection of food against bacterial spoilage, chemical agents or mechanical damage during transport/handling. Most of the materials used in the packaging industry are synthetic based plastics, which are practically non-biodegradable. Therefore, biocompatible and biodegradable polymers are good alternatives to synthetic ones. Moreover, the use of antioxidant-loaded edibles films could be an effective tool for foodstuff protection against bacterial spoilage organisms. Lately, biocompatible and biodegradable natural polymers,

including polysaccharides (chitosan, alginate, xanthan gum, dextran, salecan, pullulan, and curdlan) have been reported as promising alternatives to the synthetic ones, since they are abundant, renewable, and eco-friendly. Factors which control the synthesis of polysaccharide-based packaging materials and their features are here discussed based on the recently publications and our own results.

**Keywords:** *synthetic-based plastics, food packaging applications, green chemistry.*

### 37. ADSORPTION OF TEXTILE DYE FROM AQUEOUS SOLUTION ON NATURAL AND MODIFIED SAWDUST (communication)

*Imane Lansari<sup>1</sup>, Blekacem Benguella<sup>1</sup>, Natalia Kruchinina<sup>2</sup>, Alexey Nistratov<sup>2</sup>*

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#### **Abstract**

Natural and modified sawdust were used in adsorption of textile dye (acid green 4G) from aqueous solution. Several physicochemical analyses such as: FTIR, XRD, SEM, BET and  $\text{pH}_{\text{zpc}}$  were performed to characterize the adsorbents. The effects of contact time, adsorbate concentration and temperature were investigated. The equilibrium time was found to be achieved after 120min of contact and kinetic data were best described by pseudo second order rate equation. The acid green 4G is better adsorbed by modified sawdust. The adsorption isotherms were described by Langmuir and Freundlich equation and the equilibrium was better fitted by Freundlich model. The study of thermodynamic parameters reveals that the adsorption of acid green 4G by both adsorbents was endothermic. All the obtained results show that the modified sawdust is more practical to use in purification of water which is contaminated by textile dye than natural sawdust.

**Keywords:** *adsorption, textile dye, sawdust.*

### 38. CHARACTERIZATION OF SOME POLYMERIC COMPOSITES-POSSIBLE APPLICATIONS (communication)

*Alina Soroceanu<sup>1</sup>, Marius Soroceanu<sup>1</sup>*

<sup>1</sup>*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

#### **Abstract**

Siloxanes are polymeric compounds of organic-inorganic nature which consist of siloxane units  $(\text{SiOR}_2)_n$  and which have a very interesting set of properties, such as very low surface energy, very good permeability to gases and vapors, good stability to heat, play temperature flexibility and biocompatibility. The greatest advantage of using metal complexes based on siloxane ligands for obtaining silicone polymeric composites is given by the presence of siloxane sequences which ensure a favorable interaction with the matrix, in order to obtain the desired properties for applications in flexible devices. This materials can have possible application in many domains like, medicines in health monitoring with application in spinal cord sensor, monitoring respiration by attaching the sensor to chest; another direction of the flexible sensor is in sensing human movements this can be used to effectively monitor the movement of muscles such as bicep and also can detect small deformations in human body.

**Keywords:** *siloxanes, polymeric composites, characterization.*

### 39. OXIDATION OF CELLULOSE UNDER MILD AND SELECTIVE CONDITIONS EMPLOYING PHTHALIMIDE N-OXYL RADICAL (communication)



Gabriela Biliuta<sup>1</sup>, Raluca Ioana Baron<sup>1</sup>, Sergiu Coseri<sup>1</sup>  
<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

### Abstract

Cellulose is a linear homopolysaccharide consisting of  $\beta$ -(1 $\rightarrow$ 4)-linked glucosyl units, each of which has one primary hydroxy group (C6-OH) and two secondary hydroxy groups (C2-OH and C3-OH). Chemical reactions of cellulose have been intensively studied to add new properties or functions to native celluloses. The N-oxyl radical-mediated oxidation using, for example, phthalimide N-oxyl radical (PINO) is one of the promising candidates in new cellulose reactions fitting to the above purpose. N-hydroxyphthalimide (NHPI) as one of the best and modern catalysts, having great performances in oxidation reaction. This catalyst appears to be highly selective, only the primary hydroxyl groups being oxidized, whereas secondary hydroxyl groups remained unaffected. In this presentation, we propose some innovative protocols using powerful NHPI catalyst aiming a mild and selective oxidation of primary OH groups in cellulose.

**Acknowledgment:** This work was supported by a grant of Ministry of Research, Innovation and Digitization, CNCS/CCCDI - UEFISCDI, project number PN-III-P4-ID-PCE-2020-0476, acronym "EXCELLFUEL", within PNCDI III.

**Keywords:** *oxidation, cellulose, phthalimide N-oxyl radical.*

### 40. OXIDATIVE DEGRADATION OF PHBV/PLA/CLOISITE 30B BIONANOCOMPOSITES UNDER E-BEAM IRRADIATION (communication)

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<sup>1</sup>Laboratoire des Matériaux Polymères Avancés (LMPA), Université de Bejaia, Algeria.

<sup>2</sup>Institut de Recherche Dupuy de Lôme (IRDL), UMR CNRS 6027, Université de Bretagne-Sud, Lorient, France

### Abstract

Oxidative degradation of bionanocomposite materials under ionizing radiation is an important research field regarding their applications in biomedical as implant devices, tissue scaffolds or internal sutures. In this work, the objective was to investigate the effect of e-beam irradiation at 1 and 10 kGy on the morphology, molecular weight, barrier properties and ecotoxicity of poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV)/polylactide (PLA) blends: 50/50 (wt/wt) reinforced with 3 wt % of Cloisite 30B in presence of PHBV-g-MA added at 5 wt % and used as the compatibilizer. The bionanocomposite samples were prepared by melt compounding.

**Keywords:** *oxidative degradation, PHBV/ bionanocomposites, E-Beam Irradiation.*

### 41. COMPOSITION AND ANTIOXIDANT PROPERTIES OF EXTRACTS FROM SILVER FIR RESIDUES (communication)

Elena Butnaru<sup>1</sup>, Daniela Pamfil<sup>1</sup>, Elena Stoleru<sup>1</sup>, Mihai Brebu<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

### Abstract

Extractives of different conifer species are known to contain various compounds with biological activities. Bark, needles and cones extracts from silver fir of 40 and 100 years old were thoroughly characterized to highlight their potential use as source of valuable compounds. It was found that the silver fir samples have significant amounts of phenolic and flavonoid compounds, which increase in the cones < needled < bark order. The complex composition of the ethanol/toluene extractives shows presence of several classes of compounds such as terpenes, paraffins, acids, phenol derivatives, saccharides, and derivatives of abietic acid. This explains the antioxidant activity, with fast scavenging of DPPH radicals, especially for needles and bark. Needles stand out from bark and cones due to

the high content of terpenes in extractives. The antioxidant activity of silver fir samples indicates that these forestry residues can be a promising source for the recovery of high added-value compounds.

**Acknowledgments:** This research was funded by the grant from the Ministry of Research, Innovation and Digitization, CNCS/CCCDI-UEFISCDI, project code PN-III-P1-1.1-PD-2019-1120, contract number PD 49/2020, within PNCDI III.

**Keywords:** *antioxidant properties, silver fir residues, conifer species.*

#### **42. DESIGN AND DEVELOPMENT OF POLYMERIC MICELLES AS NANOCARRIERS FOR ANTI-CANCER RIBOCICLIB DRUG (conference)**

Zhongjie Fei<sup>1</sup>, Mehdi Yoosefian<sup>2</sup>

<sup>1</sup>State Key Laboratory of Bioelectronics, School of Biological Science and Medical Engineering, Southeast University, Nanjing, China

<sup>2</sup>Department of Nanotechnology, Graduate University of Advanced Technology, Kerman, Iran

##### **Abstract**

Understanding drug transportation and delivery mechanism from a molecular viewpoint is necessary to find better treatment pathways. Here we explored the assembly mechanism of the actions of the Ribociclib encapsulated by dodecylphosphocholine (DPC) micelle. All-atom molecular dynamics simulations were performed to explore the aggregation of DPC surfactants. The hydrophobic and van der Waals interactions are the main powerful forces for the drug encapsulation process. Hydrogen bonding and electrostatic interactions also play helpful roles in the DPC aggregation. Examines of the solvent accessible surface area and radial distribution function indicate that the DPC micelles can improve the aqueous solubility of a hydrophobic drug. This study shows the mechanism of drug loaded DPC micelles and provides new way for the design and development of drug delivery systems with necessary properties.

**Keywords:** *polymeric micelles, nanocarriers, anti-cancer, Ribociclib drug.*

#### **43. SMART MICROPARTICULATE SYSTEMS FOR THE TRANSPORT AND CONTROLLED DELIVERY OF DOXORUBICIN TO TUMOR CELLS (communication)**

Gheorghe Fundueanu<sup>1</sup>, Bogdan Cosman<sup>1</sup>, Sanda Bucatariu<sup>1</sup>, Marieta Constantin<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

##### **Abstract**

Cancer is among the leading causes of death worldwide. Surgery and chemotherapy are the most used methods for cancer treatment, unfortunately the latter with many side effects due to non-selectivity. Targeting drugs to a specific location using controlled delivery systems seems to have solved this problem to some extent. To this purpose, we developed microparticulate systems able to transport the drug intact to the desired location. As follows, poly(N-isopropylacrylamide-co-vinylimidazole) was synthesized as a smart pH/temperature-sensitive copolymer. Microspheres made of this copolymer, loaded with doxorubicin (MS-DXR), are stable in simulated bloodstream fluids (pH = 7.4, T = 36 °C), but solubilize in environments that simulate the endosomal and lysosomal conditions, releasing the payload. MS-DXR are internalized greater by HepG2 cells than A549 cells, moreover, administered in vivo, MS-DXR localized in the liver and kidneys of mice, and the loading of DXR into MS resulted in the reduced renal clearance of DXR.

**Acknowledgment:** This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0050 within PNCDI III.

**Keywords:** *Smart microparticulate systems, controlled delivery systems, doxorubicin, tumor cells.*

#### 44. PREPARATION AND CHARACTERIZATION OF DRUG-LOADED NANOPARTICLES FROM BIOCOMPATIBLE AND BIODEGRADABLE COPOLYMERS (communication)

Christelle Bertsch<sup>1</sup>, Leonard I. Atanase<sup>2</sup>, Christelle Delaite<sup>1</sup>

<sup>1</sup>LPIM, University of Haute Alsace, Mulhouse, France

<sup>2</sup>Faculty of Medical Dentistry, "Apollonia" University of Iasi, Romania

##### Abstract

The controlled delivery of drugs comes with new constraints on toxicity, biodegradability and biocompatibility for biomedical applications. Due to strict constraints, there are a limited number of polymers that can be used as matrices for the preparation of polymer/drug systems. Of these, polyesters are widely used today owing their low toxicity, biocompatibility and their ability to degrade by chemical or enzymatic hydrolysis into residues that can be assimilated by the body. The main objective of our study was to develop and characterize polymeric nanoparticles (NPs) obtained from biodegradable and biocompatible copolymers, such as poly ( $\epsilon$ -caprolactone) (PCL) and poly (lactic acid) (PLA). The first step was to synthesize diblock copolymers, whose central block is formed by a PLA sequence of constant molar mass while the terminal PCL blocks, of increasing sizes, were synthesized by ring-opening polymerization. A series of PCL-b-PLA copolymers was obtained and characterized by several physicochemical methods. In a second step, Nystatin-loaded NPs, with sizes under 200 nm, were prepared by nanoprecipitation.

**Acknowledgement:** This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2019-0664, within PNCDI-III.

**Keywords:** drug-loaded nanoparticles, copolymers, poly ( $\epsilon$ -caprolactone), poly (lactic acid).

#### 45. MICRORNAS IN CIRCULATING MICROVESICLES: NEW POTENTIAL BIOMARKERS FOR GLIOBLASTOMA RELAPSE (communication)

Natalia Simionescu<sup>1,2</sup>, Anca-Roxana Petrovici<sup>1</sup>, Sebastian Nechifor<sup>2</sup>, Răzvan Buga<sup>2</sup>, Marius Dabija<sup>2</sup>, Lucian Eva<sup>2</sup>, Adriana Georgescu<sup>3</sup>

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<sup>3</sup>Department of Pathophysiology and Pharmacology, Institute of Cellular Biology and Pathology "Nicolae Simionescu" of the Romanian Academy, Bucharest, Romania

##### Abstract

Glioblastoma (GB) is the most aggressive and recurrent form of brain cancer in adults. MicroRNAs (miRNAs) are small, non-coding RNAs that regulate gene expression and can be transported by circulating microvesicles (MVs). Circulating MVs were isolated from plasma of GB patients (before and after surgery) and of healthy subjects, followed by miRNA OpenArray profiling and quantification of specifically modified miRNAs. The OpenArray profiling identified 8 GB-specific MV-associated miRNAs. Individual quantification of miRNAs in circulating MVs showed that miR-1249-3p, miR-132-5p, miR-625-5p and miR-758-3p are expressed only in the pre-surgical group. The post-surgical levels of miR-30d-5p, miR-106b-5p, miR-486-3p and miR-766-3p were restored to control-like levels. In conclusion, we identified 8 MV-associated miRNAs specifically modified in GB, which represent potential biomarkers for monitoring treatment response and disease relapse. This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P1-1.1-PD-2019-0283, within PNCDI III.

**Keywords:** MicroRNAs, microvesicles, biomarkers, glioblastoma relapse.

**46. CYCLODEXTRIN INITIATED RING OPENING OLIGOMERIZATION OF E-CAPROLACTONE - STRUCTURAL INSIGHTS VIA MALDI MASS SPECTROMETRY AND NMR SPECTROSCOPY (communication)**

Diana Blaj<sup>1</sup>, Mihaela Balan-Porcarasu<sup>1</sup>, Valeria Harabagiu<sup>1</sup>, Cristian Peptu<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

**Abstract:**

Matrix Assisted Laser Desorption Ionization mass spectrometry (MALDI MS) represents a powerful analytical technique for characterizing complex chemical structures and monitoring the minute changes of the molecular weight. Therefore, the ring opening reaction of  $\epsilon$ -caprolactone in the presence of  $\beta$ -cyclodextrin was performed in different media in order to follow the evolution of molecular weights by both MALDI MS and <sup>1</sup>H NMR spectroscopy to confirm the obtained results. Different organocatalysts (4-dimethylamino pyridine and (-)-sparteine) and solvents (N,N-dimethylformamide and dimethyl sulfoxide) were used for the ring opening of  $\epsilon$ -caprolactone to establish their influence on cyclodextrin-oligocaprolactone (CDCL) synthesis. An excellent agreement was established between the results obtained by NMR and mass spectrometry. Moreover, the MS fragmentation studies were employed to gain further insights into the structure of CDCL product. Advanced NMR experiments revealed the CD substitution patterns.

**Keywords:** *MicroRNAs, microvesicles, biomarkers, glioblastoma relapse.*

**47. PH/THERMOSENSITIVE COPOLYMER WITH GELLING PROPERTIES FOR CONTROLLED DELIVERY OF DRUGS (communication)**

Bogdan Cosman<sup>1</sup>, Marieta Constantin<sup>1</sup>, Maria Bercea<sup>1</sup>, Gabriela L. Ailiesei<sup>1</sup>, Gheorghe Fundueanu<sup>1</sup>

<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

**Abstract**

Poloxamer 407 is a triblock copolymer with thermosensitive properties containing a central hydrophobic block of polypropylene glycol flanked by two hydrophilic blocks of PEG. Carboxymethyl pullulan (CMP) is a polysaccharide derivative with pH-sensitivity. In this work, a new copolymer with pH and temperature sensitive properties was synthesized by grafting Poloxamer 407 on CMP. The characterization of the copolymer was performed by FT-IR and <sup>1</sup>H-NMR spectroscopy. The influence of copolymer concentration on the gelation compartment was investigated by inverted vial method and rheological tests. The starting gelation time under buffer solutions with pH and temperature simulating physiological conditions was sensitive on the rest temperature before the test. The copolymer proved a high elasticity and an outstanding ability to recover the initial structure after the removal of the applied force or external stimuli. In addition, the formed hydrogel proved to be a suitable support for controlled delivery of a model drug.

**Acknowledgment:** This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0050 within PNCDI III.

**Keywords:** *pH/thermosensitive copolymer, gelling properties, controlled delivery of drugs.*

**48. TOPICAL MEDICATION OF NAIL DISEASES FROM CONVENTIONAL TO MODIFIED RELEASE DRUG DELIVERY SYSTEMS (conference)**

Lăcrămioara Ochiuz<sup>1</sup>, Cristina Mihaela Ghiciuc<sup>2</sup>

<sup>1</sup>"Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Faculty of Pharmacy

<sup>2</sup>"Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Faculty of Medicine

**Abstract**

The complexity of nail pathology ranges from simple onychodystrophies caused by tics or mental illness to severe onychoses caused by bacterial and / or fungal infections and degradation of the



matrix and nail bed in the context of severe dermatological conditions, frustrating for both patients and medical staff. The aim of this paper is to highlight the results of local therapy in the treatment of skin diseases within the latest medical discoveries in the field. Nowadays, more than ever, we can consider the nail plate as a topical way of delivering drugs, the conventional pharmaceutical dosage forms being replaced by transungual therapeutic systems that ensure the prolonged and sometimes controlled release of drug molecules.

**Keywords:** *topical medication, nail diseases, release drug delivery systems.*

#### **49. IN SILICO QSAR-BASED DISCOVERY AND MOLECULAR DOCKING OF NOVEL INHIBITORS OF THE SARS-COV-2 MAIN PROTEASE (MPRO) (communication)**

*Mehdi Oubahmane<sup>1</sup>, Ismail Hdoufane<sup>1</sup>, Driss Cherqaoui<sup>1</sup>*

*<sup>1</sup>Department of chemistry, Faculty of Sciences Semlalia, Marrakech, Morocco*

##### **Abstract**

In the present work, a QSAR study was applied to design new molecules that may have a higher inhibition activity against SARS-COV-2 Mpro. A set of 55 dihydrophenanthrene derivatives were used to establish QSAR models employing the Monte Carlo optimization and GA-MLR methods. SMILES-based descriptors were used to build QSAR models with Monte Carlo optimization. Three random splits were made and two QSAR models from each split were developed in the presence/absence of the index of the ideality of correlation (IIC). The built model of split 2 using IIC was the leading model with an  $R^2_{\text{valid}} = 0.9203$ . From the model results, the responsible promoters of increase and decrease of the inhibition activity were identified. Five novel molecules were designed from the lead compound using the promoters of increase. In order to perform further validation, these molecules were subjected to GA-MLR QSAR model to predict their inhibition activity, and they were further subjected to molecular docking.

**Keywords:** *QSAR, inhibitors, SARS-CoV-2.*

#### **50. EXPANDING THE CELLULOSE VERSATILITY TOWARDS NEW SELF-HEALABLE HYDROGELS FABRICATION (communication)**

*Raluca Ioana Baron<sup>1</sup>, Gabriela Biliuta<sup>1</sup>, Sergiu Coseri<sup>1</sup>*

*<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania*

##### **Abstract**

The oxidation of polysaccharides represents one of the most suitable approaches to introduce new functionalities able to serve for further derivatization or as anchoring sites of different molecules, broadening the applications area of these products. One convenient way to generate cellulose derivatives that are able to be processed in water, comprise of the introduction of plenty carboxyl groups, which could be done by simultaneously modifying the -OH groups in the anhydroglucose unit. New types of hydrogels based on oxidized cellulose and polyvinyl alcohol, under mild conditions, in the absence of any crosslinking agents or organic solvents were prepared and characterized. The spectral methods as well as rheology measurements were used to assess the degree of interaction between the two components. On the same conception was prepared and magnetic hydrogels, with special properties and potential applications in biotechnology/biomedicine. The magnetic hydrogels were investigated by FTIR, SEM, XRD, VSM, and thermal analysis.

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**Keywords:** *cellulose, self-healable, hydrogels.*

**51. THE EFFECT OF REMINERALIZING AGENTS WITH/WITHOUT LASER IRRADIATION ON ENAMEL PROPERTIES AND SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS (communication)**

Sabrain Naser<sup>1</sup>, Ahmed El-Bialy<sup>1</sup>, Ahmad M. Hafez<sup>1</sup>, Noha A. El-Wassefy<sup>1</sup>, Marwa S. Shamaa<sup>1</sup>  
<sup>1</sup>Mansoura University, Egypt

**Abstract**

Remineralizing agents can be used for treatment of WSL. This study aimed to assess the effect of two remineralizing agents with/without laser irradiation. This study evaluated 72 premolars in 6 groups (n=12) (I) sound enamel, (II) demineralized enamel, (III) Fluoride, (IV) Fluoride with laser, (V) CPP-ACP, and (VI) CPP-ACP with laser. The agents were applied to enamel after their immersion in a demineralizing agent. In groups IV and VI, the laser irradiated after applying the agents. 48 premolars were divided into 4 groups (n=12; F, F/L, C, C/L) and their microhardness was measured. SEM and EDS were utilized to assess the formation of hydroxyapatite. The SBS significantly decreased in group II (P < 0.001). This finding was similar to the microhardness results. Remineralizing agents can significantly improve the microhardness and structural properties of demineralized enamel to similar to that of sound enamel with no adverse effect on SBS of orthodontic brackets.

**Keywords:** remineralizing agents, laser irradiation, enamel properties, orthodontic brackets.

**52. AN INTERPENETRATING POLYMERIC SCAFFOLD BASED ON HYALURONIC ACID AND A THERMOSENSITIVE POLYMER FOR BIOMEDICAL APPLICATIONS (communication)**

Sanda Bucatariu<sup>1</sup>, Bogdan Cosman<sup>1</sup>, Marieta Constantin<sup>1</sup>, Gheorghe Fundueanu<sup>1</sup>  
<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

**Abstract**

Hydrogels play an important role in many fields, such as tissue engineering scaffolds, biosensors and drug carriers. Among these applications, interpenetrating polymeric networks (IPNs) based-natural hydrogels have become a major area of research interest simultaneously for drug delivery and in tissue engineering applications. In this study, an original strategy was employed to fabricate a novel drug delivery system by interpenetrating the thermosensitive poly(N-isopropylacrylamide-co-hydroxyethylacrylamide) (PNH) into hyaluronic acid-based scaffold (HAscF). Both hyaluronic acid and PNH were cross-linked, one after another, with poly(methyl vinyl ether-alt-maleic acid) by solvent free thermal based method. The results obtained by FTIR and SEM indicated the formation of IPN hydrogels. In vitro release studies showed that the insertion of PNH into the HAscF causes a reduction in both the release rate and initial burst effect.

**Acknowledgments:** This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0050, within PNCDI III.

**Keywords:** polymeric scaffold, hyaluronic acid, thermosensitive polymer, biomedical applications.

**53. FABRICATION OF RATIONALLY DESIGNED FUNCTIONAL HYDROGELS FOR THE CONTROLLED RELEASE OF CEPHRADINE (communication)**

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<sup>1</sup>Institute of Polymer and Textile Engineering, University of the Punjab, Lahore, Pakistan

**Abstract**

Hydrogel based drug release systems have advantage of curatively encouraging outcomes in clinical applications. In this study, novel functional hydrogels based on chitosan and polyvinyl pyrrolidone crosslinked with vinyl trimethoxy silane were fabricated via solution casting protocol.

Swelling index of prepared hydrogel samples in distilled water, buffer and electrolyte solutions was measured. Hydrogels were further characterized by Fourier transform infrared spectroscopy, thermogravimetric and X-ray diffraction analyses to investigate their possible interactions between components, thermal stability and crystallinity, respectively. In vitro analyses including antimicrobial analysis and cytotoxicity were also conducted to evaluate their biocompatibility and toxic behavior, respectively. Finally, drug release analysis using cephadrine as a model drug was carried out in phosphate buffer saline solution at 37 °C and found that cephadrine was released in controlled manner. Hence, on the basis of aforementioned results, the prepared functional hydrogels are proposed to be use in other biomedical applications.

**Keywords:** *hydrogels, controlled release, cephadrine.*

#### 54. CHITOSAN PHOTOSENSITIZER NANO-CONJUGATES FOR CANCER THERAPY (communication)

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##### **Abstract:**

Photochemical internalization (PCI) utilizes photosensitizers (PS) in combination with light excitation, to induce release of endocytosed hydrophilic drugs so they can reach their target. This therapy has been shown to be effective in the clinic but the efficiency of could potentially be further improved with polymeric nanocarriers. The aim of the current study was to develop the synthesis and investigate nanoconjugates, that were composed of cationic chitosan derivatives with covalently linked highly lipophilic photosensitizers. TBDMS protected chitosan was utilized for synthesis of highly substituted nanoconjugates. The proof-of concept study was done with tetraphenylporphyrin (TPP) as the photosensitizer. The nano-conjugates formed nanoparticle like structures with average size in the range 100-300 nm and effective for PCI mediated gene delivery . The more challenging tetraphenylchlorin (TPC) conjugates were also synthesized. These offer the advantage of possible activation and longer wavelengths and are therefore suitable for in vivo use. Preliminary in vivo experiments showed that TPC conjugates could be used to treat tumor bearing Hsd:Athymic nude-Foxn1nu female mice. These conjugates have now also been used as carriers to deliver cancer drugs.

**Keywords:** *Chitosan, photosensitizer, nano- cancer therapy.*

#### 55. CHITOSAN-PVA FILMS CONTAINING SILVER NANOPARTICLES FOR PERIODONTITIS TREATMENT (communication)

Marieta Constantin<sup>1</sup>, Mihail Lupei<sup>1</sup>, Sanda Bucatariu<sup>1</sup>, Irina M. Pelin<sup>1</sup>, Gheorghe Fundueanu<sup>1</sup>, Daniela L. Ichim<sup>2</sup>, Oana M. Daraba<sup>2</sup>

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<sup>2</sup>Faculty of Medical Dentistry, "Apollonia" University of Iasi, Romania

##### **Abstract**

The aim of the present study was to fabricate and evaluate polymeric nanocomposite thin films for simultaneous in situ delivery of antimicrobial agents (silver nanoparticles, AgNps) and anti-inflammatory drugs (ibuprofen, IBF). Herein, a facile and new approach for the synthesis of AgNps-loaded PVA films cross-linked with oxidized chitosan (OxCS) is reported. The optimally yielded CS-capped AgNps, at various concentrations, were loaded during PVA/CS film synthesis. The presence of AgNps in the film is confirmed by FT-IR spectroscopy and X-ray Diffraction analysis. The SEM images illustrate the presence of embedded AgNps throughout the films. The anti-microbial activity of the PVA/CS films have been demonstrated against Staphylococcus aureus, Pseudomonas oleovorans, Klebsiella pneumoniae, and Porphyromonas gingivalis. In addition, the film releases the loaded IBF in a controlled manner, improving the therapeutic efficacy. Therefore, the present

study clearly provides the synthesis of novel antimicrobial films with potential applications in preventing/treating infections.

**Acknowledgment:** This work was supported by a grant of Romanian Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P2-2.1-PED-2019-1780, within PNCDI III.

**Keywords:** *Chitosan-PVA films, silver nanoparticles, periodontitis treatment.*

## 56. CHITOSAN SUBSTITUTED WITH 1,2,3-TRIAZOLE AND COMMON DERIVATIVES; SYNTHESIS, CHARACTERIZATION, AND EVALUATION OF ANTIBACTERIAL ACTIVITY (communication)

Sankar Rathinam<sup>1</sup>, Martha Á. Hjálmarsdóttir<sup>2</sup>, Mikkel B. Thygesen<sup>3</sup>, Már Másson<sup>1</sup>

<sup>1</sup>Faculty of Pharmaceutical Sciences, School of Health Sciences, University of Iceland, Iceland

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### Abstract

"Click chemistry" reactions that afford products in high yields and in excellent selectivity's by carbon-hetero bond formation this methodology. Chitosan is derived from chitin, and its renewable polysaccharide which exhibits attractive biopolymer properties for many biomedical applications such as non-toxicity, biocompatibility, and biodegradability. There have been few studies on the modification of chitosan via click chemistry. The present work focused on synthesis of new type of common chitosan derivatives (TMC, TAC, HTC, HPC, and CMC) were synthesized with partial substitution so that remaining primary amino groups that could be converted to triazole were also present via copper (I) catalyzed azide-alkyne cycloaddition (CuAAC) reaction. We were successfully synthesized water soluble chito-1,2,3-triazole (chitotriazolan) with partially substituted common derivatives. The mixed chitotriazolan derivatives were characterized by IR, and NMR spectroscopy. The antibacterial activity was evaluated against *S. aureus*, *E. faecalis*, *E. coli*, and *P. aeruginosa*. The mixed chitoriazolan's were active against bacteria except chitotriazolan derived from CMC.

**Keywords:** *chitosan, 1,2,3-triazole, antibacterial activity.*

## 57. IMMOBILIZATION OF CURCUMIN IN HYDROGEL FILMS BASED ON CHITOSAN AND OXIDIZED CARBOXYMETHYLCELLULOSE WITH APPLICATIONS IN TREATING DERMATOLOGICAL CONDITIONS (communication)

Mohammed Dellali<sup>1,2</sup>, Camelia Elena Iurciuc (Tincu)<sup>2</sup>, Kheira Zanoune Dellali<sup>1,2</sup>, Nawel Spahis<sup>1</sup>, Marcel Popa<sup>2,3</sup>

<sup>1</sup> Hassiba Benbouali University of Chlef, Algeria,

<sup>2</sup>"Gheorghe Asachi" Technical University of Iasi, Romania,

<sup>3</sup>Academy of Romanian Scientists, Bucharest, Romania

### Abstract

The objectives of our study was to obtain oxidized carboxymethylcellulose (CMCOx) by oxidation of CMC in the presence of sodium periodate in order to create a new functional group, respectively the aldehyde function (-CH=O) capable of to react with the amine groups (-NH<sub>2</sub>) of chitosan (CS) by forming covalent bridges of the Schiff base type (-C=N) between the chains of two polymers. The existence of aldehyde groups in CMCOx was demonstrated by FT-IR and NMR spectroscopy. Hydrogel films were prepared based on CS and CMCOx by crosslinking using different molar ratios between the aldehyde groups of CMCOx and the amine groups of CS. The conversion index of amine groups into Schiff bases from the hydrogel films obtained and the swelling capacity were determined. Several influencing parameters have been brought into play and have been studied, such as the molar ratio, the time and the temperature of crosslinking. The selected films were



characterized by the analyzes of FTIR, SEM, TGA, mechanical resistance. Curcumin was immobilized in the films obtained based on CS/CMCOx. The release kinetics of curcumin from the films obtained and the permeability of the skin membrane were evaluated in vitro in two different pH solutions (pH=5.5 and pH=7.4) using a diffusion cell Franz. Hydrogel films can be optimized to obtain delivery systems with dermatological applications.

**Keywords:** *curcumin, hydrogel films, chitosan dermatology.*

## POSTERS

### PO1. CONCEPTUAL AND METHODOLOGICAL PERSPECTIVES FOR THE IMPLEMENTATION AND SIMILAR WASTE MANAGEMENT IN THE CITY OF ORAN (Algeria)

*Brahim Bouhadiba<sup>1</sup>, Nassima Aissani<sup>1</sup>, Mokhtaria Mekakia<sup>1</sup>, Zoubida Lounis<sup>1</sup>, Islam Hm Guertani<sup>1</sup>*

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#### **Abstract**

The objective of this study was to develop and elaborate a decision support tool for public managers in the process of sustainable waste management in the city of Oran, Algeria. It aims to contribute to the implementation of a global strategy of sustainable waste management in this city, by making available quantitative and qualitative data on the production of household and similar waste and the methodological proposal dedicated to the characterization of these residues, in order to reduce their impacts likely to harm health and/or the environment

**Keywords:** *waste management, sustainability, Oran.*

### PO2. IN VITRO TOXICOLOGY STUDY OF POLY(2-ISOPROPENYL-2-OXAZOLINE)S

*Diana Elena Giol<sup>1</sup>, Valentin Vasile<sup>1</sup>, Vlad Tofan<sup>1</sup>, Iuliana Caras<sup>1</sup>, Aurora Salageanu<sup>1</sup>, Emilian Ghibu<sup>2</sup>, Nicoleta Doriana Banu<sup>2</sup>, Florica Adriana Jerca<sup>2</sup>, Valentin Victor Jerca<sup>2</sup>*

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*<sup>2</sup>Centre of Organic Chemistry "C.D. Nenitescu", Romanian Academy, Bucharest, Romania*

#### **Abstract:**

Functional polymers play an important role in different biomedical applications, as they can be used as drug, protein, or gene carriers. Poly(2-isopropenyl-2-oxazoline) (PiPOx) showed great potential to develop biomaterials, and its stability in body fluids under physiological conditions have been reported recently. The aim of this work is the in vitro study of PiPOx as a functional polymeric material for the development of drug conjugates. Although previous studies have demonstrated the potential of PiPOx for these applications, the toxicological profile of this type of polymer as a function of the molar mass has not been investigated.

**Keywords:** *In vitro, toxicology study, poly(2-isopropenyl-2-oxazoline)s.*

### PO3. HYBRID MATERIALS WITH ANTIBACTERIAL PROPERTIES OBTAINED BY DEPOSITION 1-DEHYDRO-[6]-SHOGAOL ON MODIFIED PLYGORSKITE

*Monica Raduly<sup>1</sup>, Valentin Rădițoiu<sup>1</sup>, Alina Rădițoiu<sup>1</sup>, Violeta Purcar<sup>1</sup>, Iuliana Răut<sup>1</sup>, Mariana Constantin<sup>1</sup>, Cristian Nicolae<sup>1</sup>, Radu Fierăscu<sup>1</sup>*

<sup>1</sup>National Institute for Research & Development in Chemistry and Petrochemistry (ICECHIM), Bucharest, Romania

**Abstract:**

The phenolic chemicals in ginger, primarily gingerol and shogaol, are responsible for the multiple bioactivities of ginger, including antioxidant, anti-inflammatory, antibacterial and adjuvant in cancer treatment. This study is intended to provide data on obtaining hybrid materials with antibacterial properties by depositing of 1-dehydro-[6]-shogaol on an inorganic matrix. For improvement in the adsorption property, the surface of palygorskite was modified using 3-aminopropyl triethoxysilane or cetyl trimethylammonium bromide. Onto the modified substrates was deposited 1-dehydro-[6]-shogaol from alcoholic solution and obtained new organic-inorganic hybrids. Materials hybrid have been characterized from the structural, morphological properties and antimicrobial activity. In conclusion, the new composites combined the bacterial absorbent activity of palygorskite and the antibacterial activity of shogaol derivate, suggesting the great potential application of hybrid materials as the novel composite substances with high antibacterial activity.

**Acknowledgements:** This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-1471, within PNCDI III.

**Keywords:** *hybrid materials, antibacterial properties, 1-dehydro-[6]-shogaol palygorskite.*

**PO4. IMPROVING THERMAL PROPERTIES OF PMMA/RGO COMPOSITE THIN FILMS FOR THERMAL INTERFACES**

Raluca Tarcan<sup>1,2</sup>, Madalina Handrea-Dragan<sup>1,2</sup>, Cosmin-Ioan Leordean<sup>3</sup>, Raul Catalin Cioban<sup>3</sup>, Cosmin Farcau<sup>1,4</sup>, Adriana Vulpoi<sup>1</sup>, Simion Simon<sup>1</sup>, Ioan Botiz<sup>1</sup>

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<sup>4</sup>National Institute for Research and Development of Isotopic and Molecular Technologies, Cluj, Romania

**Abstract**

In this work, polymethylmethacrylate/reduced graphene oxide (PMMA/RGO) composite thin films have been prepared through solution blending in dimethylformamide (DMF), followed by drop-casting. Raman, SEM and AFM investigations confirmed that homogenous PMMA/RGO composite thin films have been obtained, with RGO uniformly distributed in the blending. Further investigations, in order to determine the thermo-conductive properties of the composites, have been performed. It is demonstrated that the thermal conductivity of the composite increases with the concentration of RGO in the polymeric mixture (for the highest RGO content, the thermal conductivity increases by 210%). These results are very promising for new thermal interface materials based on PMMA/RGO composites to be used in medical and automotive industry.

**Acknowledgements:** The authors acknowledge the financial support of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project no. PN-III-P2-2.1-PED-2019-3995.

**Keywords:** *thermal properties, pmma/rgo composite, thin films, thermal interfaces.*

**PO5. FABRICATION OF STRUCTURED SURFACES FROM ANTIMICROBIAL COPOLYMERS**

Iulia Babutan<sup>1</sup>, Otto Todor-Boer<sup>1</sup>, Leonard Ionut Atanase<sup>2</sup>, Ioan Botiz<sup>1</sup>

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<sup>2</sup>Faculty of Dental Medicine, "Apollonia" University of Iasi, Romania

### Abstract

In this work, we report obtaining structured antimicrobial surfaces through the employment of state-of-the-art methodologies for processing copolymers in thin films. Such methodologies are based on solvent vapor annealing and convective self-assembly and promote structuring of copolymers on surfaces via crystallization and self-assembly processes. The fabrication of structured antimicrobial surfaces is needed for the future development of efficient antimicrobial solutions.

**Acknowledgements:** The authors acknowledge the financial support of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project no. PN-III-P2-2.1-PED-2019-3995.

**Keywords:** *antimicrobial, copolymers, self-assembly.*

### PO6. NEW DRUG DESIGN BASE ON ATAZANAVIR AS POTENTIAL HIV MAIN PROTEASE INHIBITOR

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<sup>1</sup>Department of Nanotechnology, Graduate University of Advanced Technology, Kerman, Iran

### Abstract:

Starting three decades ago and spreading rapidly around the world, AIDS is an infectious disease that is distinguished from other infectious diseases by its unique ways of transmission. Because blocking enzyme activity can kill a pathogen or correct a metabolic imbalance, the design and use of enzyme inhibitors is a new approach against viruses. One of the main targets in anti-retroviral therapy is the protease because of its role in the life cycle of the virus and inhibition would prevent the maturation and the spread of the virus to neighboring cells. Several new drugs have been developed based on atazanavir, and then their binding energy and inhibitory constant were investigated using docking simulations. The best designed drug was compared with atazanavir and the molecular dynamics simulation results showed that the developed drug has better performance in HIV main protease inhibition.

**Keywords:** *drug design, atazanavir, HIV.*

### PO7. OPTIMIZATION OF CHITOSAN-BASED LIPOSOMAL FORMULATION FOR ERYTHROMYCIN

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<sup>1</sup>"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

### Abstract:

The study aims to create an optimised targeted formulation for the macrolide-class antibiotic erythromycin, by encapsulating it into a liposomal matrix followed by coating of the vesicles with biopolymer chitosan, thus increasing the stability of the lipid vesicles and allowing for later surface modification of the particles. Additionally, reducing particle size into the nanometric range can accentuate the increase in absorption and bioavailability of erythromycin. Liposomes containing various lipid to drug ratios were prepared and studied, measuring the obtained particle size, zeta potential, polydispersity index, encapsulation efficiency and drug loading in order to achieve an optimal formula. Furthermore, different methods of reducing particle size were explored and compared. It was concluded that chitosan coating of erythromycin liposomes is a great method to prepare stable liposomes towards a more approachable treatment option, considering its use in treating penicillin-allergic patients, due to its similar activity spectrum against a variety of pathogens.

**Keywords:** *chitosan, polymers, Erythromycin.*

### PO8. SPHERES-IN-GRATING ASSEMBLIES FOR BIO-APPLICATIONS

Madalina Handrea-Dragan<sup>1</sup>, Raluca Tarcan<sup>1</sup>, Otto Todor-Boer<sup>1</sup>, Adriana Vulpoi<sup>1</sup>, Ioan Botiz<sup>1</sup>  
<sup>1</sup>Babes-Bolyai University, Interdisciplinary Research Institute on Bio-Nano-Sciences, Cluj, Romania

**Abstract:**

The purpose of this research was to obtain patterned films of polystyrene that could further be employed to generate ordered/disordered spheres-in-grating functional platforms. Such platforms are fabricated by pinballing the patterned surface relief structures (e.g. channels) with various colloidal nanoparticles exhibiting promising potential for various biological applications. The aim is to alter and tune the optoelectronic properties of resulting assemblies.

**Acknowledgements:** The authors acknowledge the financial support of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project no. PN-III-P2-2.1-PED-2019-3995.

**Keywords:** *spheres-in-grating, bio-applications, pinballing.*

**PO9. HYDROGEL FILMS BASED ON BOVINE SERUM ALBUMIN/GELLAN/PECTIN CONTAINING B-CYCLODEXTRIN/CURCUMIN INCLUSION COMPLEX IMMOBILIZED WITH BIOMEDICAL APPLICATIONS**

Camelia Elena Iurciuc (Tincu)<sup>1,2</sup>, Paula Irina Merlușcă<sup>2</sup>, Marcel Popa<sup>2,3,4</sup> Lăcrămioara Ochiuz<sup>1</sup>  
<sup>1</sup>„Grigore T. Popa” University of Medicine and Pharmacy, Faculty of Pharmacy, Department of Pharmaceutical Technology, Iași, Romania  
<sup>2</sup>“Gheorghe Asachi” Technical University, Faculty of Chemical Engineering and Protection of the Environment, Department of Natural and Synthetic Polymers, Iași, Romania.  
<sup>3</sup>“Apollonia”, University Iași, Romania.  
<sup>4</sup>Academy of Romanian Scientists, Bucharest, Romania.

**Abstract**

The hydrogel films based on gellan/bovine serum albumin (BSA) with  $\beta$ -cyclodextrin/curcumin inclusion complex incorporated were prepared at pH = 7.8 by ionic cross-linking with magnesium acetate to improve the curcumin stability and bioavailability. The films thus obtained were polyelectrolyte complexed with pectin (1% solution, pH=3.5). BSA was used in this study due to its therapeutic effects, leading to improved biocompatibility of the hydrogel film. The films were characterized by swelling degree, SEM, FT-IR, TGA, mechanical tests, cytotoxicity, and the antioxidant activity was evaluated. The release kinetics of curcumin from films was performed in two different media: at pH=5.5 and pH=7.4, and a higher release efficiency was found at pH=7.4. The results confirm the biopolymer matrix protective role and the possibility of using the obtained hydrogel in biomedical applications.

**Acknowledgements:** This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI - UEFISCDI, project number PN-III-CEI-BIM-PBE-2020-0007/2 BM / 2021, within PNCDI III.”

**Keywords:** *hydrogel, bovine serum albumin/gellan/pectin, biomedical applications.*

**P10. MICRO/NANOCARRIERS FOR THE ACTIVE TARGETING OF DIFFERENT DISEASES**

Marcel Popa<sup>1,2</sup>, Anca N. Cadinoiu<sup>1</sup>, Delia M. Rata<sup>1</sup>, Leonard I. Atanase<sup>1</sup>  
<sup>1</sup>Faculty of Medical Dentistry, “Apollonia” University of Iasi, Iasi, Romania  
<sup>2</sup>Academy of Romanian Scientists, Bucharest, Romania

**Abstract**

The latest research concerning drug delivery systems is predominantly aimed at obtaining micro/nanoparticles capable not only to encapsulate the biologically active principle but especially to



transport it to the desired target where is release according to a modulated kinetic. The main advantage of this active drug targeting is a high concentration within the therapeutic level at the desired site. Two ways to ensure the active targeting emerged: functionalization of the carrier with a ligand easily recognizable by specific cells receptors, respectively the loading into the carrier of magnetic nanoparticles that allow directing at the desired site with an external magnetic field. The paper reports recent results on obtaining particles functionalized with certain ligands, but also magnetic, or even combined, intended for active targeting of diseases such as skin or liver cancer, diseases of the inner ear and respiratory system.

**Acknowledgment:** „This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P4-ID-PCE-2020-2009, within PNCDI III”.

**Keywords:** *Micro/nanocarriers, liver cancer, inner ear respiratory system.*

### **P11. CHITOSAN MEMBRANES WITH HEMP (CANNABIS SATIVA L) AND SAGE (SALVIA OFFICINALIS FOLIUM) PLANT EXTRACTS USED AS POTENTIAL BIOMATERIALS**

*Mihaela Barbalata-Mandru<sup>1</sup>, Alin Enache<sup>2</sup>, Maria Spiridon<sup>1</sup>, Mioara Drobotă<sup>1</sup>, Gabriela Hitruc<sup>1</sup>, Florica Doroftei<sup>1</sup>, Magdalena Aflori<sup>1</sup>*

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<sup>2</sup>*SC Apel Laser SRL Bucuresti*

#### **Abstract**

Chitosan has gained growing interest recently because it is a promising natural substance that can be used in the biomedical fields. Chitosan membranes associated with different substances such as plants extracts, have beneficial effects in the control of infection replacing the resistance of some bacteria to antibiotics. This study aims to prepare chitosan membranes to be incorporated with two plant extracts from leaves of hemp (*Cannabis Sativa L*) and sage (*Salvia officinalis folium*) plant extracts for being use as an antibacterial biomaterial. We first describe the method of obtaining the two plant extracts, and second we highlighted the method to prepare membranes. The results obtained was homogeneous membranes. We use Fourier Transform Infrared (FTIR) Spectroscopy to verify the incorporation of the extracts in the membrane. This incorporation can be applied to improve the performance of membranes with chitosan for use as antibacterial biomaterials.

**Keywords:** *Chitosan, Cannabis Sativa L, Salvia officinalis folium, biomaterials.*

### **P12. TESTED CELLS FOR BIOMEDICAL DEVICE GELATIN-BASED WITH IRON OXIDE FOR IMPROVING MRI IMAGING**

*Mioara Drobotă<sup>1</sup>, Maria Butnaru<sup>2</sup>, Magdalena Aflori<sup>1</sup>*

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<sup>2</sup>*Department of Biomedical Sciences, “Gr. T. Popa” University of Medicine and Pharmacy Iasi, Romania*

#### **Abstract**

Tissue engineering is a viable alternative domain to enable tissue reconstruction by addressing the need of those medical device who are need the replacement or impruvement. Therefore, the cells are used for various tests, in replacement therapy, or for implantation. Endothelial precursor cells may localize to tissues and to growing tumor to participate to neovascularization. Cell-internalized nanoparticles render the cell body magnetically responsive, which resists through adhesion forces when adhering to a substrate. We have developed a new device gelatin-based with different particles is developed to induce a good functionalities for expanded using the particles for improving by MRI imaging.

**Keywords:** *biomedical device, gelatin-based with Iron oxide, MRI imaging.*

### **P13. ADSORPTION DU CHROME (III) ET DU NICKEL (II) PAR UNE BENTONITE SODIQUE**

Makhoukhi Benamar<sup>1</sup>, Benguella Belkacem<sup>1</sup>

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### Abstract

A common characteristic of all industrial effluents is that they almost always contain toxic metals; environmental protection requires limiting the levels of these metals as much as possible. Nowadays, bentonites are widely used in the field of wastewater treatment. One of the essential properties of a bentonite is the ability to adsorb heavy metals as well as organic substances contained in aqueous solutions. In our work, we used a sodium bentonite for the adsorption of two metals in solution. The aim is to improve the adsorption yields of metals by bentonite and also to optimize the various operating conditions (contact time, volume of the aqueous phase, speed of agitation, initial concentration of the metal, pH and temperature). The dosage of chromium (III) and nickel (II) ions present in the aqueous phases is carried out by atomic absorption spectrophotometer.

**Keywords:** bentonites, wastewater treatment, heavy metals.

### P14. HYDROGELS FOR USE IN THE TREATMENT OF WOUNDS BASED ON ZEOLITE, L-ARGININE AND CAFFEINE IN THE POLYMER MATRIX

Alina-Mirela Ipate<sup>1</sup>, Diana Serbezeanu<sup>1</sup>, Corneliu Hamciuc<sup>1</sup>, Yuri Kalvachev<sup>2</sup>, Simona Gherman<sup>3</sup>

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### Abstract

Hydrogels are the most iconic class of soft materials. The purpose of this study was to make gels to be used to treat wounds. In this respect, new hydrogels based on chitosan, polyvinyl alcohol and L-zeolite loaded with L-arginine and caffeine, were obtained. L-arginine (L-arg) and caffeine (Caff) were added as active ingredients during the preparation of the hydrogels. Freeze-dried methods were also used to prepared hydrogels with L-arg and Caff. For these new materials, the degree of loading, the efficiency of loading were determined and in vitro release tests were performed. The results showed that both caffeine and arginine have positive effects on wound healing application. The loading efficiency of the drugs in different formulations proved to be in the range of 85.09 - 99.27%. The high loading efficiency is due to the presence of PVA which, according to FT-IR spectra, also allowed strong drug interactions.

**Acknowledgements:** The authors acknowledge the financial support of CNCSIS-UEFISCSU, Project Number PN-III-P1-1.1-TE-2019-0639, nr. 89/03.09.2020.

**Keywords:** hydrogels, zeolite, l-arginine, caffeine.

### P15. POLYMER-MAGNETIC NANOPARTICLES-5-FLUOROURACIL SYSTEM FOR TARGETED CANCER THERAPY

Kheira Zanoune Dellali<sup>1,2</sup>, Corina-Lenuța Savin<sup>2</sup>, Mohammed Dellali<sup>1,2</sup>, Abdallah Ouagued<sup>1</sup>, Marcel Popa<sup>2,3</sup>

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### Abstract

Cancer is one of the deadliest diseases in the world. Controlled drug delivery systems offers great opportunities for the development of new non-invasive strategies for the treatment of cancers and the main advantage of these systems is represented by their capacity to accumulate in tumors by enhanced permeability and retention effect. We focused our research on

hybrid magnetic nanoparticles (nanospheres) based on chitosan obtained by double crosslinking in reverse emulsion. Hybrid nanoparticle consisting of a polymeric matrix in which is dispersed a magnetic nanoparticles material (magnetite (Fe<sub>3</sub>O<sub>4</sub>), maghemite (γ-Fe<sub>2</sub>O<sub>3</sub>), hematite (α-Fe<sub>2</sub>O<sub>3</sub>), etc.), are lately studied for use as target delivery systems of antitumor drugs. Selection of the matrix-forming polymer is based on the need for it to be biocompatible, biodegradable, mucoadhesive, possessing reactive functional groups in order to achieve the cross-linking process under mild reaction conditions. The hybrid nanoparticles nanospheres formed is characterized in order to determine their shape and size; these particles are from a few tens to a few hundred nanometers in diameter. SEM confirmed their nanometric size and their well-defined spherical shape. These nanospheres allowed the encapsulation of an increased amount of 5-Fluorouracil and presented a controlled drug release.

**Keywords:** *Polymer-magnetic nanoparticles, 5-fluorouracil system, targeted cancer therapy.*

#### **P16. OPTIMIZATION AND STRUCTURE ACTIVITY RELATIONSHIP OF CHITOSAN-HYDROXYCINNAMIC ACID CONJUGATES**

*Vivien Nagy<sup>1</sup>, Priyanka Sahariah<sup>1</sup>, Martha Á. Hjálmarsdóttir<sup>1</sup>, Már Másson<sup>1</sup>*

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##### **Abstract**

A new synthesis procedure was developed and optimized by the Design of Experiments (DoE) approach for conjugating hydroxycinnamic acids (HCA-s) to chitosan. Cinnamic acid and tert-butyldimethylsilyl (TBDMS) protected HCA-s were converted to their corresponding acyl chlorides and reacted with 3,6-di-TBDMS-chitosan to selectively form amide linkages. Nineteen conjugates were obtained with degrees of substitution (DS) ranging between 3% and 60%. The conjugates possessed improved aqueous solubility compared to unmodified chitosan and were found to be bactericidal against *Staphylococcus aureus* and *Escherichia coli*. The antibacterial activities were equal to chitosan at low DS, however, an increase in the DS correlated with reduced activity. The EC<sub>50</sub> values were determined using DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging assay. While unmodified chitosan only exhibited low antioxidant activity, the HCA-chitosan conjugates enhanced antioxidant activities, correlating with the DS. One caffeic acid conjugate (DS=21%) was found 4000 times more active than chitosan and more active than free caffeic acid.

**Keywords:** *chitosan-hydroxycinnamic acid conjugates, caffeic acid.*

#### **P17. DOUBLE EMULSION MICROCAPSULES: SYNTHESIS AND PHYSICOCHEMICAL CHARACTERIZATION**

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##### **Abstract:**

The use of microcapsules have been a popular topic within the last decades due to attractive properties and wider applications. Effective protection of the encapsulated active agent against degradation and the ability to control the rate of release of the embedded drug over long periods of time, are their main advantages. The purpose of this study was to obtain microcapsules based on chitosan, poly(vinyl alcohol) and an activator [4-(4,6-dimethoxy-1,3,5-triazin-2-yl)-4-methylmorpholinium chloride]. The microcapsules were prepared by double emulsion - condensation method and were characterized from several points of view. FTIR spectroscopy was used to confirm the formation of ester and amide bonds into the structure of microcapsules. The mean diameter and surface aspects were evaluated by DLS and SEM. The zeta potential showed values of approximately

-30mV and was evaluated to investigate the stability of the aqueous dispersion of microcapsules. The degree of swelling was determined in solutions that mimic biological fluids.

**Acknowledgment:** „This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P4-ID-PCE-2020-2009, within PNCDI III”.

**Keywords:** *double emulsion microcapsules, polymers, physicochemical characterization.*

## **P18. EVALUATION AND POSTGRADUATE CONTINUING PHARMACEUTICAL EDUCATION USING ONLINE PLATFORMS**

*Sha'at Mousa<sup>1</sup>, Bujor Alexandra<sup>1</sup>, Stamate Monica - Iliuța<sup>1</sup>, Crețeanu Andreea<sup>1</sup>, Popa Eliza Grațielă<sup>1</sup>, Gafițanu Carmen<sup>1</sup>, Ștefanache Alina<sup>1</sup>, Ochiuz Lăcrămioara<sup>1</sup>*

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### **Abstract**

Lifelong learning, depends on 3 factors: time, duration, and continuity of learning process. This process means to access current knowledge and information to enhance the competence of pharmacists' practice. The National Pharmaceutical Continuing Education Program (EFC) involves, in addition to forms of postgraduate courses, continuing pharmaceutical education that can be achieved through online platforms that registered an increase during the COVID-19 pandemic. The easy access to information and the possibility to watch the recorded event without having to contact the specialist at a certain moment conducted to the development of applications both in the web field and in the mobile variants of e-learning platforms. Due to travel limitations and maintaining physical distance, but also for other reasons, the development of the pharmaceutical information system has facilitated pharmacists' access to specialized materials by reducing two major problems during the SARS-CoV-2 virus pandemic: time and the space needed for the lifelong learning process.

**Keywords:** *EFC, e-learning, COVID-19, pharmacist, education, platforms.*