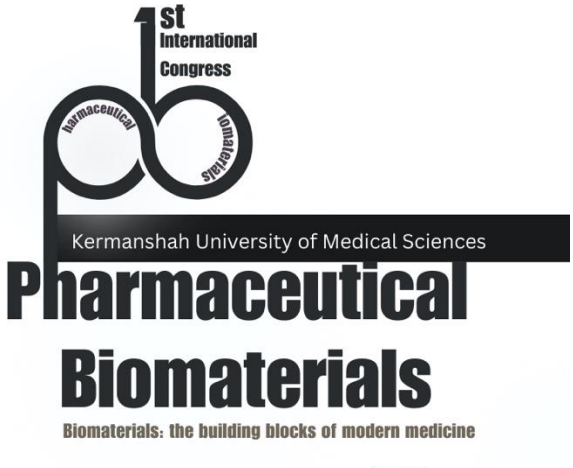
In The Name of God



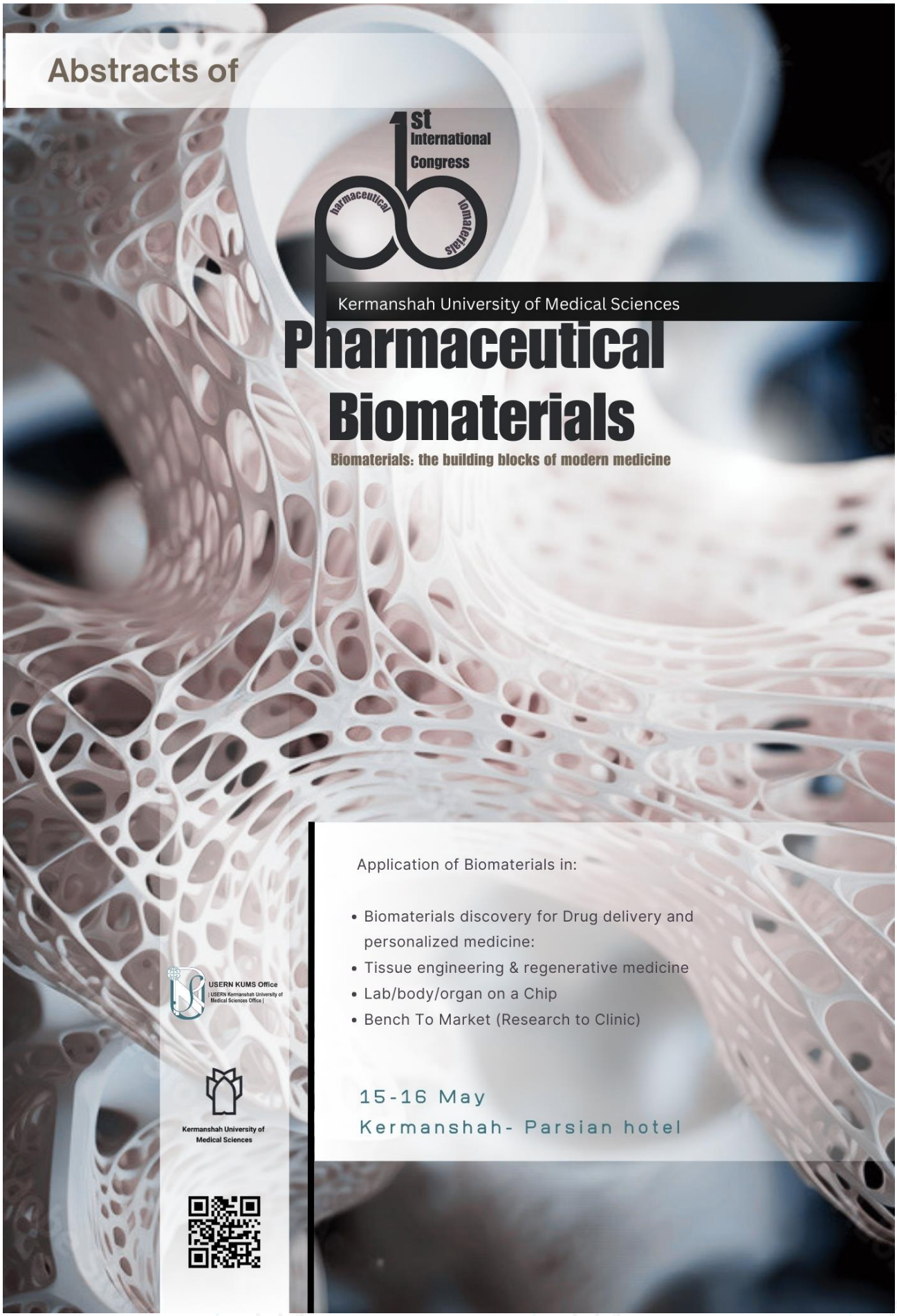
1st International Congress of Pharmaceutical Biomaterials

ICPB2024

Cutting-edge Biomaterials Design

Application of Biomaterials in:

- **Biomaterials discovery for Drug delivery and personalized medicine (15 May)**
- **Tissue engineering & regenerative medicine(15 May)**
- ***Lab/body/organ on a Chip* (16 May)**
- **Bench To Market (Research to Clinic) (16 May)**


Abstracts of
1st International Congress
Pharmaceutical Biomaterials
Kermanshah University of Medical Sciences
Pharmaceutical Biomaterials
Biomaterials: the building blocks of modern medicine
Application of Biomaterials in:
• Biomaterials discovery for Drug delivery and personalized medicine:
• Tissue engineering & regenerative medicine
• Lab/body/organ on a Chip
• Bench To Market (Research to Clinic)
15-16 May
Kermanshah- Parsian hotel
USERN KUMS Office
USERN Kermanshah University of Medical Sciences Office
Kermanshah University of Medical Sciences

Biomaterials discovery for Drug delivery and personalized medicine

1.

An innovative Shilajit-based nanocarrier for doxorubicin delivery to breast cancer cells (MCF-7)

Zahra Asadi[1], Faranak Aghaz[2], Saba Jalilian[2]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.

2. Nano Drug Delivery Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.

Abstract: Breast cancer (BC) is the most common cancer in the world. Based on the progressing trend of cases, this disease will become the leading cause of death in the world. Therefore, effective treatment strategies are needed to deal with the increasing rate of BC. Chemotherapy is a standard strategy in the treatment of BC, with hundreds of antitumor drugs, including doxorubicin. Doxorubicin is one of the most widely used chemotherapy drugs for cancer treatment. Although this drug has strong anti-proliferative effects, its toxicity for healthy cells, especially cardiac cells, multiple drug resistance, low solubility, and its short half-life are among the treatment challenges with this drug. These challenges have led researchers to use nano-systems to formulate chemotherapeutic agents. Nanotechnology is an effective tool in targeted cancer treatment that can improve treatment results. However, achieving efficient bioavailability of these platforms has been challenging due to their simple structure compared to complex biomolecular interaction systems. Current studies use nanocarriers based on materials derived from nature to counter these concerns. In the present study, a new Shilajit-based nanocarrier (SNC) was developed as a system for doxorubicin delivery to BC cells (MCF-7). The fabrication of this nanocarrier was done by the nanoprecipitation method as a simple, easy, and affordable approach. After confirming the physicochemical properties of the synthesized SNCs, their cytotoxic effects on MCF-7 cells were investigated. The doxorubicin-loaded SNC showed a spherical shape with a size of 248 nm and a zeta potential value of -17.7 mV. The controlled release of doxorubicin happened gradually over 48 hours. As well as the ability of this nanocarrier to enhance the delivery of doxorubicin to cancer cells was confirmed. After 48 hours, SNC-Dox was found to exhibit high cytotoxicity against MCF-7 cells even at low concentrations. Therefore, SNC is a promising carrier offering a new clinical cancer treatment strategy.

Keywords: Shilajit-based nanocarrier, Breast cancer, Doxorubicin, Cellular toxicity

2.

Comparative Analysis of Sericin and Gluten in Advanced Nanocarriers for Magnetic Nanoparticle-Enabled Drug Delivery to Breast Cancer Cell line

Saba Jalilian[2], Faranak Aghaz[2], Zahra asadi[1], Kiana bahremand[2]

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

2. *Nano Drug Delivery Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

Abstract: Breast cancer poses a multifaceted challenge for women worldwide. Early detection and appropriate treatment are crucial for improving survival rates and aiding women in overcoming this obstacle. The discussion highlights the intricate relationship between magnetic nanoparticles and drug delivery. Magnetic nanoparticles (MNPs) offer an outstanding platform for drug delivery due to their exceptional properties, including, biocompatibility, and responsiveness to magnetic fields. The magnetic characteristics of Fe3O4@SiO2-PTA are utilized to facilitate targeted drug delivery, enabling precise localization within cancer cells. This study assesses the effectiveness of sericin and gluten in delivering Fe3O4@SiO2-PTA magnetic nanoparticles to breast cancer cell line MCF-7. Various techniques, such as DLS, ZETA potential, XRD, VSM, and FTIR are employed to thoroughly examine the physicochemical properties of these carriers. The study meticulously evaluates the efficacy of sericin and gluten in promoting the targeted delivery of magnetic particles to breast cancer cell lines (MCF-7). Phosphotungstic acid (PTA) has promising anti-cancer properties, as explored in this investigation. Our findings suggest that sericin is more effective at inducing cytotoxicity in targeted cancer cell lines than gluten.

Keywords: Breast cancer, Protein, MNP

3.

PLA-PCL-PEG-PCL-PLA micelles for improving ocular permeability of dexamethasone: synthesis, formulation, in vitro and ex vivo evaluation

Mitra Alami-Milani[1] , Mitra Jelvehgari[2], Parvin Zakeri-Milani[3], Hadi Valizadeh[4], Marziyeh Fathi[5], Sara Salatin[6], Roya Salehi[7]

1. Department of Pharmaceutics, Faculty of Pharmacy, Urmia University of Medical Sciences, Urmia, Iran

2, 3, 4. Department of Pharmaceutics, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran

5, 7. Research Center for Pharmaceutical Nanotechnology, Tabriz University of Medical Sciences, Tabriz, Iran

6. Neurosciences Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran

Abstract: Objectives: Ocular drug delivery is one of the most challenging issues that pharmaceutical scientists encounter. Ocular bioavailability of topically administered drugs is less than 5%. Micelles have been studied for improving topical ocular delivery of hydrophobic drugs. In this contribution, our goal was to investigate the feasibility of developing polylatide-polycaprolactone-polyethylene glycol-polycaprolactone-polylatide (PLA-PCL-PEG-PCL-PLA) based micelles to improve ocular permeability of dexamethasone (DEX). Methods: The PLA-PCL-PEG-PCL-PLA copolymers were synthetized by a ring opening polymerization method and their critical micelle concentrations (CMCs) were determined. DEX was loaded into the developed micelles and dex-loaded micelles were characterized using TEM and DLS. The cytotoxicity of the micelles obtained was investigated on L929 cell line, and their cellular uptake was followed by means of fluorescence microcopy and flow cytometry analyses. The release behavior of DEX from the micelles as well as the drug release kinetics were investigated, and the corneal permeability was evaluated using an *ex vivo* bovine model. Results: The pentablock copolymers were successfully synthetized. The TEM results verified the formation of spherical micelles, the sizes of which were approximately 65 nm. The micelles exhibited a suitable compatibility on L929 cells. The release profile showed an initial burst release followed by a sustained release, the kinetic of which was close to the Weibull's distribution model. The micelles showed higher corneal permeability in comparison to a marketed DEX eye drop. Conclusion: Taken together, the results of this study indicated that the PLA-PCL-PEG-PCL-PLA micelles could be appropriate candidates for ocular delivery of DEX, and probably other hydrophobic drugs.

Keywords: dexamethasone, ocular permeability, micelles, pentablock copolymer, cellular

4.

Synthesis, formulation, *in vitro* and *ex vivo* studies and evaluation of *in vivo* anti-inflammatory effect of dexamethasone loaded PCL-PEG-PCL micelles

Mitra Alami-Milani[1] , Mitra Jelvehgari[2], Parvin Zakeri-Milani[3], Hadi Valizadeh[4], Marziyeh Fathi[5], Sara Salatin[6]

1. Department of Pharmaceutics, Faculty of Pharmacy, Urmia University of Medical Sciences, Urmia, Iran

2, 3, 4. Department of Pharmaceutics, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran

5. Research Center for Pharmaceutical Nanotechnology, Tabriz University of Medical Sciences, Tabriz, Iran

6. Neurosciences Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran

Abstract: Objectives: The ocular bioavailability of most topically administered drugs is less than 5%. Micelles have been studied as tools for improving topical delivery of hydrophobic drugs to the eye. The aim of this study was to investigate the capability of polycaprolactone-polyethylene glycol-polycaprolactone (PCL-PEG-PCL) micelles in improving the anti-inflammatory effects of dexamethasone (DEX). Methods: PCL-PEG-PCL copolymers were synthesized by ring opening polymerization of ε-caprolactone. DEX was loaded as a model hydrophobic drug into the obtained copolymers by using of a film hydration method. The DEX-loaded micelles were characterized by transmission electron microscopy (TEM) and dynamic light scattering (DLS). The release behavior of DEX from the micelles was studied. *In vitro* cytotoxicity of the micelles obtained was investigated on L929 cells. Cellular uptake was followed by using of fluorescence microscopy and flow cytometry analyses. Finally, the anti-inflammatory impact of the prepared micelles was investigated on endotoxin-induced uveitis (EIU) in rabbits. Results: TEM and DLS results verified the successful formation of spherical micelles, the sizes of which were approximately 37 nm. The micelles exhibited acceptable compatibility with L929 cells and were internalized into the cells in a concentration- and time-dependent manner. The micelles were found to provide a very low initial burst release (7.80% after 2 h) followed by a sustained-release which lasted for 5 days. The results of animal studies demonstrated a better, but not statistically significant, impact of the DEX-loaded micelles on EIU than a marketed DEX eye drop. Conclusion: The results showed that PCL-PEG-PCL based copolymers can be used as a platform for the treatment of anterior eye disease.

Keywords: **Dexamethasone, ocular drug delivery, polymeric micelles, endotoxin-induced uveitis**

5.

Investigation of the Impact of DPPG and Cholesterol on Fucoxanthin Liposome Stability and Physicochemical Properties Using Molecular Dynamics Simulation

Mina Shaban [1,2], Somaieh Soltani[3,4], Mahmoud Reza Jaafari[1,2]

1. *Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*
2. *Nanotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran*
3. *Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran*
4. *Pharmaceutical Analysis Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*

Abstract: Liposomes are lipid-based vesicles that have gained significant attention in drug delivery systems due to their ability to encapsulate various compounds[1]. As well as fucoxanthin, a natural carotenoid found in brown seaweeds, which possesses notable antioxidant and anticancer properties. When incorporated into liposomes, fucoxanthin's bioavailability and stability are enhanced, making it a promising candidate for drug delivery applications. DPPG (di palmitoyl phosphatidylglycerol), a negatively charged lipid, and cholesterol, a sterol compound, play pivotal roles in shaping the properties of liposomal membranes. Understanding how the presence of DPPG and cholesterol influences the structural integrity, stability, and interactions within fucoxanthin-loaded liposomes is crucial for optimizing their performance as drug delivery vehicles[2, 3]. In this article, we will discuss how DPPG and cholesterol affect the stability of liposome of fucoxanthin (Li-FX) using molecular dynamic (MD) simulation to find an approximate formulation of Li-FX. In this research, we use material studio software and a coarse-grained molecular dynamics approach to simulate the impact of DPPG and cholesterol on Li-FX stability. By finding some parameters, such as energy and mechanical properties. The obtained result indicates that the Li-FX formulation has a higher loading efficiency and stability when 10% cholesterol and 5% DPPG are added, as opposed to other formulations that contain a lower and higher percentage of cholesterol and DPPG. In summary, MD simulations have proven to be a valuable tool for understanding the behavior and mechanisms of liposomes, which can be used as drug delivery systems. These simulations provide insights into the structure, stability, and formation mechanisms of liposomes, as well as their interactions with other molecules and cellular components. By using MD simulations, researchers can design optimal, suitable, and biocompatible liposomes as potential drug carriers, ultimately contributing to the development of more effective drug delivery systems.

Keywords: Drug delivery, Molecular dynamics simulations, Liposome, Fucoxanthin, Stability

6.

Liposomal Minoxidil: Enhancing Doxil's Antineoplastic Efficacy in Colon Carcinoma Mouse Models

Vahideh Mohammadzadeh[a,b], Leila Arabi[a,b], Seyedeh Maryam Hosseinikhah[a,b], Mohammad Reza Zirak[c], Mohammad Mashreghi[a,b], Mahdi Hatamipour[a,d], Hossein Kamali[b], Mahmoud Reza Jaafari[a,b,e]**

a *Nanotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran*

b *Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*

c *Department of Pharmacodynamics and Toxicology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*

d Department of Medical Chemistry, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

e Biotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract: Chemotherapy with nanoparticles (NPs) is often ineffective against tumors due to the dense tumor microenvironment (TME) and limited permeability. Minoxidil (MXD), an antihypertensive vasodilator, effectively overcomes micro-barriers in the neoplastic environment, improving NPs penetration via intercellular and paracellular pathways and the enhanced permeability and retention (EPR) effect. In our study, we developed liposomal-MXD utilizing passive loading techniques to enhance NPs penetration in advanced colon carcinoma. In a BALB/c mice C26 colon cancer model, three doses of 15 mg/kg MXD-liposomes significantly reduced tumor stroma. Enhanced Doxil accumulation and penetration, alongside improved median survival in C26 colon carcinoma mice, emphasize MXD-liposomes' potential in cancer treatment through TME modulation.

Keywords: Minoxidil, Liposomes, Doxil, Enhanced permeability and retention (EPR) effect, Tumor Penetration,

7.

ZnO-Gd-DOX Nanoparticles: A great potential platform for drug delivery and diagnosis imaging

Mina Pourhabib Mamaghani[1], Hosein Azimian[2]

1. *Medical Physics Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.*
2. *Medical Physics Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.*

Abstract: Today, nanoparticles have made progress advancements, especially in the field of medicine. The combination of ZnO-Gd-DOX nanoparticles, which consist of zinc oxide (ZnO) nanoparticles, gadolinium (Gd), and doxorubicin (DOX), represents a versatile strategy for cancer treatment. ZnO-Gd-DOX nanoparticles are known as a highly potent tool in the field of cancer therapy, especially for drug delivery and diagnostic imaging. These bifunctional nanoplatforms, exhibit strong red fluorescence, that facilitates imaging in living animals. They also damage cancer cells by generating reactive oxygen species and induce cell death without detectable toxic side effects .In addition, ZnO-Gd-DOX nanoparticles have been used in chemo-photothermal therapy to improve regulated drug delivery and targeted tumor treatment. In addition, the integration of ZnO-Gd-DOX with various substances such as folic acid (FA) has led to the development of nanocomposites that exhibit synergistic effects, thereby increasing their therapeutic potential particularly in cancer therapy. Therefore, ZnO-based nanoplatforms, including ZnO-Gd-DOX nanoparticles, could be a promising tool in the field of cancer treatment and diagnosis. The focus of this study is first on the introduction of ZnO-Gd-DOX nanoparticles, followed by a detailed explanation of their role in treatment and diagnosis.

Keywords: ZnO-Gd-DOX nanoparticles, drug delivery, diagnosis imaging, anti-tumor theranostic nanoparticles, cancer treatment

8.

Doxorubicin-Loaded Magnetic Polydopamine Iron Oxide Nanoparticles: An Integrated Nanoplatform for Targeted Chemo-Photothermal Management of Melanoma

Mahvash Dehghankhold

Abstract: Malignant melanoma is a particularly dangerous type of skin cancer due to its metastatic nature. Globally, there has been an alarming rise in the incidence of this cancer among Caucasian populations over the last fifty years. Surgical intervention is typically the preferred treatment for melanoma in its initial stages. However, in advanced stages, surgery might not be as effective. Non-surgical alternatives such as radiation therapy, immunotherapy, phototherapy, cryotherapy, and chemotherapy are available. Despite its notoriety, managing melanoma therapeutically continues to pose significant challenges. Theranostic nanoparticles (NPs) have gained considerable attention in the field of cancer imaging and treatment. In this study, our objective was to develop a versatile nano system capable of targeted delivery of both photothermal and chemotherapy agents. To achieve this, we modified Fe3O4 NPs with polydopamine and bovine serum albumin, and loaded them with DOX using a thermal-cleavable Azo linker (Fe3O4@PDA@BSA-DOX). Under the specified conditions, the Fe3O4@PDA@BSA NPs had an approximate size of 98 nm. The incorporation of Fe3O4 and PDA in the NPs endowed them with the ability to convert light into heat. When exposed to an 808 nm NIR laser with a power density of 1.5 W/cm2, the temperature of the Fe3O4@PDA@BSA NPs increased to around 47 °C within 10 minutes. This generated heat caused the AZO linker to break, resulting in the release of the drug. In both in vivo and in vitro experiments, the NPs effectively eradicated tumor cells under laser irradiation without causing significant toxicity. Additionally, the Fe3O4@PDA@BSA NPs demonstrated potential as contrasting agents. Their accumulation in tumors, facilitated by an external magnet, led to a substantial improvement in the quality of magnetic resonance imaging (MRI). Overall, these novel multifunctional NPs show promise as an efficient system for imaging and combination therapy in melanoma.

Keywords: Iron Oxide, Chemo-Photothermal, Melanoma

9.

Current Advances in Parkinson's Disease drug delivery, a review

Mahsa Karami [1,2]

1. *Department of tissue engineering, Faculty of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Parkinson's disease, a debilitating neurodegenerative disease, affecting dopaminergic pathways in brain, currently devastates a large proportion of the elderly population by motor and non-motor symptoms like bradykinesia, tremor, rigidity, cognitive impairment and mood disorders. Parkinson's disease has been a hot topic in both neurological and pharmacological studies for its vague complex pathological pathways, inefficient symptom-reliving medications, lack of disease-modifying treatments and considerable financial burdens. In this review, we aim to do a comprehensive overview of the latest advances made in Parkinson's disease drug delivery to combat the most well-known obstacles of these systems the permeability of the blood brain barrier, undesired particle degradation. It is also challenging to reach optimum bioavailability, dosage, absorption, distribution and pharmacokinetics. We start from dopamine precursors and repurposing other drugs, then move to recent immunotherapy technics and later, cover unconventional anatomic routes (e.g. trans-buccal and nose to brain), lastly, we will be thoroughly discussing nanoparticle drug delivery system, Nano-bubbles, Nano-capsules, micelles microspheres and small molecules.

Keywords: Parkinson's disease, drug delivery, nanoparticles

10.

The importance of studying angiogenesis and its models

Masoume Rostami [a,b], Kamran Mansouri [c]

a Kermanshah University of Medical Sciences, Kermanshah, Iran

b Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

c Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Angiogenesis refers to the process of developing new capillaries from existing vessels. This complex process is influenced by various factors and involves a series of cellular events, including the migration, proliferation, and differentiation of endothelial cells, culminating in the formation, maturation, and regeneration of blood vessels. Angiogenesis plays a crucial role in physiological events such as growth, development, wound healing, and reproduction, as well as in pathological events like tumor growth, metastasis, and various chronic diseases. The regulation of angiogenesis depends on a delicate balance between natural stimulators and inhibitors in the body. When this balance is disrupted, it can lead to conditions such as corneal angiogenesis, endometriosis, obesity, arteriosclerosis, and psoriasis, as well as the growth and metastasis of tumors. In recent years, the inhibition of angiogenesis has emerged as a novel approach for controlling and treating disorders associated with angiogenesis, particularly tumor growth and metastasis. Researchers have extensively studied angiogenesis, developing various in vitro and in vivo models to explore inhibitory factors and induce angiogenesis for therapeutic applications. These models have utilized different extracellular matrices, including fibrin, L-type collagen, Matrigel, or a combination of these proteins with other agents. Additionally, synthetic polymers such as polyethylene alcohol have been employed as extracellular matrices for angiogenesis model preparation. These models have significantly contributed to understanding blood vessel formation biology and drug discovery applications. Our team has conducted a study on designing an economical angiogenesis kit model that has demonstrated superior results compared to the commercial Matrigel model. This innovative model holds promise for advancing angiogenesis research and drug development.

Keywords: Angiogenesis, Drug discovery, In vitro models, Extracellular matrices

11.

Antiulcerogenic Activity of Nanoparticles of *Pistacia atlantica* Oleoresin

Maryam Naseri[1], Sama Naderi Tabar[1], Hanieh Delfani[1], Mohammad Hosein Farzaei[2], Shahla Mirzaeei[2], Leila Behbood[2]

1. *Student Research Committee, Faculty of Pharmacy, Kermanshah University of Medical Sciences, Kermanshah, Iran*

2. Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: *Pistacia atlantica* was recognized as a plant with therapeutic properties that are traditionally employed for the treatment of various diseases. This study focused on its oleoresin nanoparticles, particularly for the management of gastrointestinal ailments. These nanoparticles were fabricated from the oleoresin of *Pistacia atlantica* and then investigated to determine their potential antiulcerogenic and protective properties in rat models with ethanol-induced gastric ulcers and acetic acid-induced ulcerative colitis. The ethanol and acetone as solvents were used for the synthesis of *Pistacia atlantica* oleoresin nanoparticles via the nanoprecipitation method and characterized by different characterization analyses.

Different doses of *Pistacia atlantica* oleoresin nanoparticles (50, 100, and 200 mg/kg) were administered to rats in the respective ulcer models. The characteristics of synthesized nanoparticles including size, dispersion index (nPDI), zeta potential, and surface characteristics were evaluated, alongside macroscopic and microscopic therapeutic effects in vivo models. The optimized nanoparticles showed a size of 173.6 nm and an nPDI of 0.06, implying superior uniformity and stability. The presence of terpenoids in the nanoparticles from *Pistacia atlantica* oleoresin was also represented by FT-IR results, which contributed to the therapeutic effects of these nanoparticles.

All doses of the fabricated nanoparticles significantly improved ulcer damage compared to control groups in both ulcer models, with the 200 mg/kg dose exhibiting the most effective antiulcer and anti-inflammatory properties. Microscopic studies also confirmed the ulcer-healing properties of synthesized nanoparticles. This study demonstrates the significant antiulcerogenic and protective effects of fabricating nanoparticles from *Pistacia atlantica* oleoresin in rates models with ethanol-induced gastric ulcers and acetic acid-induced ulcerative colitis.

The optimized nanoparticles, encapsulating terpenoids from the oleoresin, showed better therapeutic properties compared to the raw extract. Administration of various doses of *Pistacia atlantica* oleoresin nanoparticles significantly led to reduced ulcer damage, while the 200 mg/kg dose exhibited superior efficacy in improving ulcer damage and reducing inflammation in the gastrointestinal tract.

Keywords: *Pistacia atlantica*, Oleoresin nanoparticles, Antiulcerogenic, Therapeutic properties, Gastrointestinal ailments

12.

Smart biomaterialomics: integrating data-driven approaches for next-generation biomaterials

Maryam Naseri [a,b,c,1], Zhila Izadi [b,c,2], alireza lotfabadi [a,2]

a *Kermanshah University of Medical Sciences, biomaterial Faculty, Kermanshah, Iran*
b *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*
c *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Smart biomaterialomics as a new approach introduces a paradigm shift for biomaterial development through the integration of the principles of material genome design with advanced computational tools and sophisticated data analysis techniques, which are guided by artificial intelligence (AI). This review explores the pivotal role of this approach in the future advancement of biological materials with improved properties control, and accelerating the adoption of biomaterials in various applications. The goal of smart biomaterialomics developments is to expedite the design of next-generation biomaterials and implants by utilizing data integration of multiple omics, machine learning algorithms, and advanced manufacturing processes like 3D printing to manufacture personalized implantable biomaterials and medical devices for clinical performance.

The key factor of this approach's success is the management of a huge amount of biocompatibility experimental data and the seamless integration of these data with computational tools and precise, complex physics models, along with the utilization of online databases of clinical studies. This approach streamlines the translation of the conception to the clinic in the biomaterial development process, particularly for patient-specific implants, additive manufacturing techniques, and innovations in bioelectronic medicine.

To improve our understanding of smart biomaterialomics, we provide examples in this article that illustrate the convergence of AI research and biomaterial development. However, the advancement of this approach requires the use of various new technologies and data-driven strategies. There are successful examples of using AI-based design software and techniques to enhance the predictive design capabilities of biomaterials, such as bio-PLA and metal-organic frameworks (MOF). This integration can also fabricate sustainable and cost-effective biomaterials, alongside discovering biomaterials with reduced carbon footprints and adjusting nanoscale surface properties for medical applications. This collaborative approach enables predictive modeling of biomaterial performance, informed decision-making, and accelerated innovation in biomedical and clinical applications by overcoming the challenges of traditional biomaterial development, such as long development cycles and associated high costs.

As a result, smart biomaterialomics represents great potential for revolutionizing biomaterial research and the development of next-generation biomaterials. It offers a promising path to address various healthcare challenges and advance high-performance, personalized solutions for diverse applications.

Keywords: Smart biomaterialomics, Data-driven approaches, Artificial intelligence integration, Next-generation biomaterials

13.

An Updated Review on Advances in Hydrogel-Based Nanoparticles drug delivery for Liver Cancer Treatment

1st Mohammed Namiq Amin, 2nd Bahareh Farasti Far

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah 6715847141, Iran*

2. *Department of Chemistry, Iran University of Science and Technology, Tehran 16846-13114, Iran*

Abstract: Over 90% of liver cancers are hepatocellular carcinomas (HCC), which are often caused by diseases including metabolic syndrome, alcoholism, and viral hepatitis. Chemotherapy and immunotherapy are now the main treatments available for HCC, with a view of fighting the complex network of variables that contribute to the disease's origin. Conventional chemotherapy, however, presents difficulties as it can negatively impact healthy cells and tissues unintentional. The promise of hydrogel-based nanoparticles for the treatment of liver cancer is the main emphasis of this article's thorough analysis of current developments in drug delivery systems. By delivering therapeutic compounds specifically to the tumor site, these hydrogels provide a potential way to reduce systemic adverse effects while using the accuracy of localized chemotherapy.

The review examines several kinds of hydrogels and highlights how important it is to optimize medication delivery for HCC by taking advantage of these hydrogels' ability to release slowly. Thermosensitive, pH-sensitive, photosensitive, dual-sensitive, and glutathione-responsive hydrogels are some of the hydrogels that are emphasized; each of these hydrogels has a distinct quality that increases its ability to target malignant cells while preserving healthy tissues. When it comes to treating liver cancer, hydrogel-based drug delivery approaches are more effective than conventional systemic chemotherapy. The capacity to modify hydrogels to adapt to certain circumstances in the tumor microenvironment guarantees a focused and prolonged release of chemotherapeutic agents. This reduces negative effects on healthy tissues while simultaneously improving therapeutic results.

The review's findings highlight the considerable potential of hydrogel-based nanoparticles in transforming drug delivery techniques, particularly as researchers and physicians look for new ways to treat liver cancer. This strategy has the potential to advance precision medicine in the field of treating hepatocellular carcinoma by using the special qualities of hydrogels. This thorough investigation advances the current discussion about improving molecular therapeutic approaches for liver cancer and moves us one step closer to more efficient and user-friendly therapeutic methods.

Keywords: hepatocellular carcinoma, liver cancer, hydrogel, controlled-release, drug delivery systems

14.

Organic biomaterials, an evolution in tumor immunotherapy

Mohammadtaha Gerami

University of medicine, Kermanshah University of Medical Sciences, Kermanshah, I.R Iran

Abstract: As the population increases in size and age, the growing number of cancer patients and mortalities has become a universal concern. there have been significant develops in tumor treatment through recent years and immunotherapy is one of the fields which provides useful capabilities to limit and reverse tumor growth process.

More and more investigations are conducted to application of biomaterials to multiply drug delivery, precision therapy, drug uptake, control release and circulation time. Organic biomaterials show considerable positive effects in bioavailability, efficiency in position and adaptivity with tissue and body metabolism compared to artificial ones that made them an appropriate choice to cooperate in immunotherapy procedure. This review has named and explained briefly about some of these materials.

There are three types of organic biomaterials. *Synthetic polymer materials* are high molecular-weight compounds including many structural units. polylactic acid (PLA)as an example, is a type of thermoplastic aliphatic polyester including lactic acid monomers. excellent biocompatibility, harmlessness, clarity and heat resistance announce PLA as a good item to choose. PLA nanoparticles in covalent amalgamation with anti-RNEU and anti-CD40 antibodies motivate an anti-tumor immune feedback which has been utilized in a research and indicated significant impression.

Natural biomacromolecular materials do not indicate pH change caused by synthetic materials and provide better biodegradability. Natural polysaccharides, are one of the products in this field. Hyaluronic acid is a type of acidic mucopolysaccharide. water-solubility, adaptability, and degradability are some beneficial principles for the material. It also provides CD44-targeting features. As a biomedical stuff, gelatin exposes biocompatibility, low immune stimulus, and simplicity to work with. Within these criteria, the widespread usage of gelatin is explainable. In an investigation, an injectable, gelatin-based microhydrogel complex sheathed on Car-T cells could result in efficient cell therapy. Microgel-recovered CAR-T cells entirely eradicated tumor cells, displaying a cytotoxic response aiming human ovarian cancer in vitro and on 3D tumor circumstance.

Cell-derived bioactive materials are actually cell membranes. They have different sources which means diverse biological functions are available. Erythrocyte, platelet, macrophage, tumor, and modified bacterial membrane differ in characteristics and furnish many possibilities. During an investigation, it has been offered a tumor-associated macrophage cell membrane (TAMM), which stems from initial tumors and has proper antigen-homing rapport and immunocompatibility. TAMM covered with nanoparticles can excite macrophages from M2-like phenotype to M1-like ones and subsequently cause immunologic cell death; this phenomenon advocates the production of tumor-specific effector T cells in metastatic tumors via antigen-presenting cells activation, hence developing the performance of anti-tumor immunity.

The usage of new biomaterials in medicine, especially immunotherapy can provide an opportunity and by optimizing current platforms, seems to create a promising approach in cancer treatment.

Keywords: Organic biomaterials . Immunotherapy . Cancer tumor . Immune cell . Cell membrane

15.

pH-Responsive psyllium Mucilage/Poly (vinyl alcohol) nanofibers whit Multi-effect properties for controlled delivery of mesalamine

Mohammad-Sajjad Ataei[1,2], Zhila Izadi[2,3]

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*
2. *Pharmaceutical Sciences Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran*
3. *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Inflammatory bowel diseases (IBDs) are chronic autoimmune conditions that impact the gastrointestinal tract, leading to damage to the epithelium. Mesalamine, also known as 5-aminosalicylic acid, is a commonly prescribed medication for inducing remission in these diseases, with a particular focus on local delivery. This study aimed to develop a novel drug delivery system for Mesalamine using electrospinning techniques, with a dual purpose of enhancing acid resistance and promoting prebiotic activity. Psyllium Extracted-Mucilage, chosen for its prebiotic properties that support beneficial gut bacteria, and its ability to bond, disintegrate, emulsify, form films, suspend, and thicken, it is mainly used as an auxiliary in pharmaceutical preparations. However, according to previous studies, it is hard to convert pure mucilage to nano fiber and it must be modified/blended with other polymers. Therefore, extracted-Mucilage was combined with Poly(vinyl alcohol) to aid in the electrospinning process. Additionally, a layer of Eudragit polymer was applied to confer responsiveness to changes in pH levels. Analysis of the nanofibers produced using scanning electron microscopy revealed consistent, smooth, and defect-free structures. The incorporation of Eudragit was effective in reducing the release of Mesalamine in low pH conditions, mimicking the acidic environment of the gastrointestinal tract. Furthermore, the nanofibers exhibited improved adhesion to mucosal surfaces and demonstrated prebiotic effects. This research successfully showcased the development of a versatile drug delivery system with prebiotic activity, mucosal adhesion properties, and pH-resistance capabilities, all aimed at optimizing Mesalamine delivery and enhancing its retention in the intestines and colon.

Keywords: Mesalamine, Psyllium mucilage, Novel drug delivery system, Electrospinning, Cytotoxicity, Nanofiber

16.

Evaluation of the therapeutic effect of rutin nanoformulation in an animal model of rheumatoid arthritis induced by complete Freund's adjuvant

Mohammad Mehdi Gravandi[1,2], Mohammad Hossein Farzaei[2,3*]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Pharmaceutical Sciences Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

3. Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Rheumatoid arthritis (RA) is the most common chronic inflammatory disease, primarily affecting the joints and with stromal tissue dysregulation causing chronic inflammation and joint destruction. Rutin is a natural flavonoid with potential therapeutic properties in chronic destructive conditions including rheumatoid diseases. In this study, the protective effects of rutin nanoformulation in an animal model of rheumatoid arthritis caused by Freund's complete adjuvant (FCA) were investigated. Sixty male rats were randomly divided into ten groups including normal, negative control, prednisolone 10 mg/kg (positive control), 3 doses of rutin (15, 30, 45mg/kg), rutin nanoparticles (15, 30, 45mg/kg), and nanoparticle without rutin, for 28 days. Different behavioral parameters including the open field test, acetone drop test, hot plate test, Von Frey test, and inclined plane test were evaluated. Serum levels of glutathione(GSH), catalase, and nitric oxide as well as histopathological analyses were measured in different groups. Also, matrix metalloproteinase (MMP)-2 and MMP-9 activity were appraised by gelatin zonography. The injection of FCA prolonged the rats' immobility duration in comparison to the control group. Rheumatoid arthritis induction also increased nitric oxide and decreased GSH and catalase levels, while these effects were reversed in the groups that received nanoparticles containing rutin and prednisolone. Rutin nanoparticles suppressed MMP-9 and activated MMP-2. Also, this rutin drug delivery system plays a significant role in the improvement of histopathological symptoms. Considering the improvement of behavioral and tissue symptoms and the modulation of the level of inflammatory cytokines, nanoparticles containing rutin can be proposed as a suitable approach in the management of patients with rheumatoid arthritis.

Keywords: Chitosan nanoparticles, Rutin, Freund's complete adjuvant, Rheumatoid arthritis

17.

A review of robotic pills with GI injection

Sajjad Ghobakhlou[1,2]

1. *Pharmaceutics, Pharmacy, Kermanshah Medical Sciences, Kermanshah, Iran*
2. *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: In the contemporary era, there are many effective treatments that cause poor compliance and jeopardy of treatment due to limitations and side effects. The method we are discussing is the robotic pill, which was transformed from diagnostic use (endoscopy) into a method for treatment in 20 years. At the same time, RP uses the advantages of oral and injectable formulas because it does not have their complications and limitations. This method uses micro-robotic systems. RP was proposed for the first time in subcutaneous and intramuscular drugs and easily digestible drugs with the possibility of absorption. In simple terms, in this method, the robotic capsule containing the drug is swallowed and anchored in the desired location, which is a part of the intestine, after stabilizing the position of the drug by the microneedle, it is injected into the wall of the gastrointestinal tract. used topically to prevent other systemic effects of these drugs. Up to this point, methods such as the use of intestinal protective coatings, protease inhibitors, and intestinal penetration enhancers were used to deliver drugs to the right place in the gastrointestinal environment, which caused concerns such as dose changes, damage to the protective barrier of the digestive system, factors Safety, tolerability, effectiveness, bioavailability, effect of food on performance and time of drug administration and delivery had drug and food interactions. Compared to injection systems, the most significant benefit in its entirety is the patient's adherence to the treatment path, while injecting into the intestine is completely painless. Totally, this method increased reliability up to 80% and bioavailability up to 65% (oral 1%). This technique can add other capabilities, including frequent injections even when the patient is sleeping. This device weighs 3 to 4.5 grams and measures 11 x 26 mm with a diameter of 2.5 to 3 mm. The size of the tank is 0.847 ml and 3.5 mg. It has the main components of battery/receiver/transmitter/reservoir. / needle and secondary components of camera/diode/lens/recorder. Its types of remote control methods are: radio/magnetic/time. It needs at least 2 main anchoring mechanisms (balloon inflation or magnetic cilia) to fix the position and drug release mechanism (amount and number of doses). In the end, it is removed from the body by peristaltic movements. Among the limitations of this method, we can point out the limitation of the capacity of the needle and the tank and the development of the anchoring mechanism to the limitation of the battery and energy consumption. Robotic capsules are being prepared to reach prime time. It should be noted that this technique has been tested in animal and human models and has obtained ethical approvals. Currently, it can be used for insulin/actinoid/growth hormone/PTH/Factor 8. Most of these studies have used the MEMS microelectromechanical system.

Keywords: robotic pill, drug delivery, injection systems, robotic capsule needle

18.

Preparation and characterization of solid and in situ forming implants as drug delivery system using biodegradable and biocompatible polymers for co-delivery of melatonin and progesterone in livestock.

Fatemeh Majdi[1], Hamid Akbari Javar[2], Mojtaba Mojtahedzadeh[3]

1. *Department of Pharmaceutical Biomaterials and Medical Biomaterial Research Center , Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.*
2. Department of Pharmaceutics, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.
3. Department of Clinical Pharmacy, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.

Abstract: Melatonin is a hormone, an ancient molecule found in plants and animals. Melatonin, a pleiotropic indoleamine, possesses amphiphilic properties so that it can readily cross from blood or cerebral spinal fluid into tissues and cells, as well as through the blood brain barrier. Melatonin is mainly secreted from the pineal gland. Furthermore, it is found in high concentrations in body numerous tissues. In addition to its role as a hormone and regulator of sleep and circadian rhythms, its a neuroprotectant, immune modulator, and an antioxidant for the brain and body. It also plays a role in Cancer, Aging, Pregnancy, Sepsis, Cardiovascular disease, etc. Melatonin synthesis and secretion are controlled by the suprachiasmatic nucleus (SCN), the body's master clock. The pineal gland, plays the role of a functional neuroendocrine messenger through its ability to synthesize melatonin. It takes part in the conversion of the visual signal into a hormonal signal that are recognized by tissues containing specific melatonin receptors. Melatonin regulates the frequency and quantity of pulsatile secretion of hypothalamic hormones and pituitary gonadotropic hormones, thus controlling the process of reproduction. In mammals, the duration of the nocturnal pineal melatonin signaling is shaped by the photoperiod and is an important regulator of the annual cycles of reproduction, metabolism, and growth.
In this study, the melatonin and progesterone implant drug delivery system is investigated in order to increase the efficiency of existing systems in reproductive control in livestock. Two solid and in situ forming implant models are made and compared. Solid implant is made by compression method and in situ forming implant with solvent exchange method. In vitro studies for solid implants include erosion and degradability, DSC, FTIR, SEM, mechanical properties, content uniformity test, release test, and biocompatibility test. In vitro studies for in situ forming implant, including evaluation of gel properties, viscosity and rheological behavior studies, investigation of gel formation in laboratory conditions, SEM, FTIR, degradation studies and release test. In vivo studies for both implants are performed on female rats and drug release, measurement of LH, FSH, prolactin and progesterone and histopathology are investigated.

Keywords: Melatonin, Progesterone, Solid Implant, In situ forming implant, Co-Delivery

19.

Investigating the impact of cold atmospheric plasma-induced therapeutic species delivery on apoptosis induction in colon cancer stem cells within a 3D culture environment

1st Abolfazl Soulat, 2nd Leila Roshangar, 3rd Taghi Mohsenpour

1,3 Department of Atomic and Molecular Physics, Faculty of Sciences, University of Mazandaran, 47416-13534, Babolsar, Iran.

2. Stem Cell Research Center, Tabriz University of Medical Sciences, 5166614766, Tabriz, Iran.

Abstract: Cold atmospheric plasma (CAP), a gas mixture partially or fully ionized and devoid of significant thermal energy, comprises photons, charged particles (electrons and ions), neutrals, and free radicals. It exhibits considerable potential across diverse biomedical applications, particularly in the realm of cancer therapy. This study delves into the impact of TCAP on the apoptosis process of colon cancer stem cells (CCSCs) cultivated within a 3D culture environment, employing an innovative two-step cold atmospheric plasma transfer method named TCAP. TCAP facilitates the efficient delivery of reactive oxygen and nitrogen species (RONS) to influence CCSCs by inducing cytotoxicity through a continuous two-step delivery mechanism. By utilizing Annexin V and qtr.-ELISA methodologies, pivotal cellular factors of apoptotic CCSC cells affected by TCAP treatment, such as apoptotic cell count and the expression of BAX and BCL-2 proteins, were examined. The results indicate a significant augmentation in apoptotic cell count (p value <0.0001) and favorable alterations in BCL-2 and BAX gene expression (p value <0.0001) subsequent to TCAP treatment of CCSCs. In conclusion, this investigation underscores the anticancer potential of TCAP and its efficacy in diminishing the survival rate of CCSCs, positioning TCAP as a promising alternative for CCSC therapy.

Keywords: cold atmospheric plasma, apoptosis induction, colon cancer stem cells, therapeutic species delivery

20.

An insight into hydrogen sulfide-releasing wound dressings

Saba Sayyareh[1], Reza Karimi-Soflou[1], Akbar Karkhaneh[1*]

1. *Biomedical Engineering, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran*

Abstract: Chronic wound management has long been considered as an ever-growing challenge in the healthcare system, threatening the lives of patients all over the world. Multiple factors should be met for a wound to be effectively healed. In the case of chronic wounds, we are facing an abnormal complexity, causing an impairment in the healing process. If left untreated, these wounds could lead to amputations or death. The main characteristics of chronic wound environments include long-term inflammation, hindered angiogenesis, and unresolved infection. Therefore, active molecules that could help the wound find its natural healing path are in high demand. Recently, hydrogen sulfide (H_2S), an endogenous gasotransmitter, has attracted researchers' attention. This gas was considered notorious for a long time due to its poisonous nature. This was until studies discovered the dependency of H_2S's effects on its concentration. Any variation from its natural concentration can result in undesired outcomes. It has been shown that the concentration of H_2S is significantly decreased in chronic wounds. H_2S can directly or indirectly improve angiogenesis, kill bacteria, scavenge radicals, and reduce inflammation by activating or deactivating signaling pathways, mainly through protein persulfidation. One of the attractive features of H_2S is that it can simultaneously have all the above-mentioned therapeutic effects. Conventional and affordable hydrogen sulfide donors such as NaHS have a low half-life and lack the required consistency in their release. Another limitation of H_2S is its concentration, which should not surpass its therapeutic window. To this end, different carriers, mainly including macro- and nanoparticles, hydrogels, and electrospun fibers that incorporate H_2S donors physically or chemically, have been developed. These carriers provide a controlled and sustained release of H_2S over required periods of time during different wound healing phases. The purpose of this review is to share the potential of these carriers as interactive wound dressings.

Keywords: Chronic wounds, Wound dressing, Hydrogen sulfide, Hydrogen Sulfide Generating-Carriers

21.

Hydrogen sulfide-releasing microparticles for diabetic wound treatment

Saba Sayyareh[1], Reza Karimi-Soflou[1], Akbar Karkhaneh[1*]

1. *Biomedical Engineering, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran*

Abstract: Wound healing is a multifaceted procedure itself, requiring the contribution of several cells and chemicals working all in harmony. However, underlying conditions such as diabetes, in which patients deal with metabolic dysfunctions, add additional complexities, resulting in impaired healing. To overcome this issue, multifunctional wound dressings that help fight infection, reduce inflammation, and improve angiogenesis are highly demanded. The infamous endogenous gas, hydrogen sulfide (H_2S), has recently gained a lot of attention for its various biological roles. This gas acts as a stimulus for different signaling pathways, which have roles in angiogenesis and radical scavenging. The use of this single molecule would considerably help accelerate diabetic wound healing. To this end, smart dressings that provide H_2S release could be designed. In this work, a controlled release of H_2S using microparticles as a wound filler dressing was achieved. For this purpose, sodium hydrosulfide (NaHS) was encapsulated within polylactic acid (PLA) particles and synthesized using a water-in-oil-in-water emulsion technique. When contacting wound exudate, NaHS hydrolyses and generates H_2S. Scanning electron microscopy (SEM) confirmed that the particles were spherical in shape and had a mean diameter of 8.5 ± 2.9 μm and a low polydispersity of 0.15. The microparticles had a high yield of 78 ± 5% and encapsulation efficiency of 80 ± 6.2%. The particles also helped achieve a controlled release. The release profile of H_2S showed an initial burst release of 40 μM followed by a sustained release of 5 μM over 10 days, which was lower than free NaHS. MTT assay was also taken from the microparticles in the presence of fibroblasts. The particles showed no toxicity toward cells and significantly promoted fibroblast growth and proliferation. Overall, the synthesized NaHS-loaded microparticles show potential to be used as diabetic wound dressings either alone as bioactive fillers or when incorporated into various wound dressings.

Keywords: Microparticle, Hydrogen Sulfide Release, Polylactic Acid, Diabetic Wound Treatment

22.

Designing a system based on anti PD-L1 peptide-dendrimer conjugates for cancer immunotherapy

Zahra Kheyri[1], Mazda Rad-Malekshahi[1*]

1. Department of Pharmaceutical Biomaterials and Medical Biomaterials Research Center, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

Abstract: Cancer is a significant disease and the second leading cause of death worldwide. Therefore, discovering a more effective treatment method with fewer side effects for cancer could be a major step toward improving global health. Today, activating the immune system has shown positive effects in controlling advanced tumors and it is a suitable method for the treatment of advanced cancers.

Recent findings have shown that cancer cells can evade the body's immune system by expressing certain proteins such as PD-L1, on their surface. This causes the immune system to stop attacking the cancer cells. To combat this, monoclonal antibodies called checkpoint inhibitors have been developed. These antibodies bind to the surface proteins of tumor cells, which removes the inhibition of the immune system. As a result, the immune system can effectively eliminate the cancer cells.

Due to, antibody instability, limited effectiveness, less tumor penetration, anti-antibody response, complex production procedures, and the high cost, alternative agents are being investigated. Thus, new biological methods such as the phage display technique are being used to identify peptide ligands with high affinity to target proteins like PD-L1 protein. However, using these peptides alone is not a good alternative as they are small and cleared quickly. Adding a bulky and biodegradable group like dendrimers to these peptides can prepare better alternatives to existing antibodies, which have not been used for this protein so far. It should be mentioned that these systems can be used as a platform for other peptides to inhibit other Checkpoint molecules such as PD1, LAG3, etc.

In our study, the objective is to design a PD-1/PD-L1 pathway inhibitor using a specific anti-PD-L1 peptide conjugated to a Citric acid-PEG-Citric acid (CPEGC) dendrimer, which hinders the PD-1/PD-L1 pathway on the surface of tumor cells. By doing so, it aims to induce cancer cell death through the activation of killer T cells. Additionally, the study intends to evaluate the tracking and imaging capabilities of the developed system by creating a complex between the dendrimer and the radioisotope 99mTc and conducting in vivo studies.

Keywords: PD-L1 inhibitors, Cancer immunotherapy, Dendrimers

23.

A biomacromolecule based hydrogel with thermo-responsive behavior and improved mechanical properties to simulate aggressive breast cancer

Reyhane Shokri[1] Miguel Fuentes-Chandía[2] Jafar Ai[3] Mehryar Habibi Roudkenar[4] Mazda RadMalekshahi[1] Seyed Nasser Ostad[5]

[1] Department of Pharmaceutical Biomaterials, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

[2] Department of Biology, Skeletal Research Center, Case Western Reserve University, Cleveland, Ohio, United States

[3] Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran

[4] Burn and Regenerative Medicine Research Center. Guilan University of Medical Sciences, Rasht, Iran

[5] Toxicology and Poisoning Research Center, Department of Toxicology and Pharmacology, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

Abstract: The development of three-dimensional (3D) culture models is promising for cancer biology studies and the discovery of new anticancer drugs because they mimic the in vivo situation better without the need for animal facilities. To reach a 3D culture matrix, we developed a temperature-sensitive hydrogel inspired by the native tumor biology approach. Hence, methylcellulose (MC), hyaluronic acid (HA), and silk fibroin (SF)were combined to mimic the native extracellular matrix. A new bioengineered tumor model was designed using thermo-sensitive blend hydrogel (MCHASF). The homogeneous encapsulation of cells in this hydrogel was easily achieved at incubator temperature (37 °C). The cells were recovered from hydrogels without harsh detachment agents at room temperature after forming multicellular structures. Evaluation of physicochemical properties showed that the hydrogel has an interconnected porous structure and bulky hydrophilicity with high water absorption. The stability of the hydrogels was sufficient for long-term culture, and their elastic modulus was similar to that of breast tumors. /MDA-MB-231 cells were cultured in MCHASF hydrogel, and the results showed that the growth and proliferation of cells in the hydrogel were comparable to that observed in vivo. The cells were also efficiently spread, and adhesion in the hydrogel was associated with cell protrusions. Increased migration rate and overexpression of MMP2, MMP9, and VEGF proteins showed that this hydrogel tumor model has metastatic potential.

Moreover, The MDA-MB-231 cells cultivated in this model were less sensitive to chemotherapy than 2Dcultures. Overall, our 3D tumor model can recapitulate the critical features of tumors in vivo. Importantly, novel MCHASF hydrogel with high viability for recovered cells can be used in the future for downstream analyses, including microRNA assay, qPCR, and flow cytometry imaging. This will enable us to assess genes and protein expression related to tumor progression, and investigate cell death profiling that could be useful in drug discovery. This platform will be a suitable option for examining the response of patients to chemotherapy, which is based on the personalized medicine method using cells taken from the patients themselves.

Keywords: 3D tumor model, MDA-MB-231 cells, Thermo-sensitive hydrogel, Personalized medicine

24.

Targeted protein modification as a paradigm shift in drug discovery

Roshanak Amirian [a,b,c,1], Hossein Derakhshankhah [b,c,2], Zhila Izadi [b,c,3]

a Kermanshah University of Medical Sciences, Kermanshah, Iran
b Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran
c USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Targeted Protein Modification (TPM) is an umbrella term encompassing numerous tools and approaches that use bifunctional agents to induce a desired modification over the proteins. One emerging approach in the TPM context that is generating significant interest is Targeted Protein Degradation (TPD). TPD represents a creative approach to drug discovery, utilizing autophagy or the Ubiquitin-Proteasome System (UPS) to selectively degrade specific target proteins. TPD is an innovative method that allows us to specifically break down certain proteins using specially designed molecules or peptides, like PROteolysis-TArgeting-Chimera (PROTACs). PROTAC-based targeted degradation offers several advantages over conventional small-molecule inhibitors and extends across a spectrum of proteinopathies emerging potential applications of these innovations in cancer therapy, neurodegeneration, viral infections, autoimmune and inflammatory diseases, promising to arrest disease progression at its molecular roots. This extraordinary method selectively targets mutant forms of pathogenic which are deemed "undruggable" due to structural constraints, and delivery challenges as are intracellular scaffolding proteins or transcription factors lacking active binding sites while sparing healthy counterparts and disrupting disease propagation at its source (1-4). Moreover, directed degradation to specific tissues is facilitated by cell- or tissue-restricted E3 ligases, ensuring precision in therapeutic action in PROTAC design. At its core lies the strategic use of biomaterials as carriers for precise delivery of degradation agents, underscoring their innate biocompatibility and versatility. Additionally, advanced linkers play a crucial role in enhancing the efficacy of TPM by improving carrier stability, pharmacokinetics, and tissue targeting. Examples of advanced linkers include polyethylene glycol (PEG), which can be conjugated to protein carriers to prolong circulation time and enhance tissue penetration, ultimately augmenting therapeutic efficacy (5). Nowadays, the ever-increasing number of tools and strategies for modulating and modifying the POI has expanded far beyond protein degradation, which phosphorylation and de-phosphorylation of the protein of interest, targeted acetylation, and selective modification of protein O-GlcNAcylation are among them. These novel strategies have opened new avenues for achieving more precise outcomes while remaining feasible and minimising side effects.

Keywords: Targeted Protein Modification (TPM), Targeted Protein Degradation (TPD), PROTAC, Biomaterials

25.

Synthesis and identification of gold-mesoporous silica-based nano bio composites modified with amino groups for the delivery of doxorubicin drug

sepideh geravand[1], mobina mostafavi[2],

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*
2. *Student Research Committee, mazandran University of Medical Sciences, mazandaran, Iran*

Abstract: Cancer is a condition in which cells in the body grow uncontrollably and spread to other areas. Cancer cells are divided into structures and functions, and the growth of isolated cells. The exact cause of this phenomenon is unknown, but it is possible that genetically or selectively activated cases of nuclear cells in the nucleus will cause abnormalities. These include radioactive materials, Toxins and chemicals , or excessive sunlight.

It is a major cause of illness and death globally, with a projected 13.1 million cancer-related deaths by 2030. In a healthy organism, there is always a balance between cell division, normal cell death, and differentiation, but cancer cells Break away from the normal mechanisms of cell division and growth.

Doxorubicin is an anticancer drug. In cancer, doxorubicin inhibits topoisomerase II, which also produces free radicals and inhibits DNA and RNA production and cell Membrane destruction.

Doxorubicin affects and kills tumor cells in the two Stages of cycle and rest. In this study, doxorubicin was loaded on porous gold-silica mesoporous nanoparticles as drug carriers and modified by amines Groups and encapsulated by natural and synthetic curcumin polymers.

The synthesized nanocomposites were prepared by the bonding method and required X-ray diffraction,BET,SEM and various IR methods. Biological activities of these nanoparticles based on the release rate of doxorubicin from the nanocomposite showed that this substance was evaluated in two acidic and neutral environments on a Laboratory scale. The release results of doxorubicin showed that this substance Shows an average release of approximately 100 h in both media. In an acidic Environment with pH = 5.5, we observe a longer release. From the release of doxorubicin, which were studied in different nanocomposite environments, we We conclude that these nanocomposites based on gold-silica mesoprose can be used as drug nanomaterials with a suitable drug-release rate.

Keywords: cancer, nanocarrier, doxorobicine, mesoproussilica, drug delivery

26.

Prospects of plant-derived exosome-like nanocarriers in oncology and tissue engineering

Hafez Karimi[1], Shima Rahmati[2], Morteza Alizadeh[3], Amir Hossein Khazaei[4], Ana Cláudia Paiva-Santos[5,6], Leila Rezakhani[7,8], Esmaeel Sharifi[9,10]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Cancer Research Center, Shahrekord University of Medical Sciences, Shahrekord, Iran

3. Department of Tissue Engineering, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

4. Student Research Committee, Shahid Beheshti University of Medical Sciences, Tehran, Iran

5. Department of Pharmaceutical Technology, Faculty of Pharmacy of the University of Coimbra, University of Coimbra, Coimbra, Portugal

6. REQUIMTE/LAQV, Group of Pharmaceutical Technology, Faculty of Pharmacy of the University of Coimbra, University of Coimbra, Coimbra, Portugal

7. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

8. Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran

9. Cancer Research Center, Hamadan University of Medical Sciences, Hamadan, Iran

10. Department of Tissue Engineering and Biomaterials, School of Advanced Medical Sciences and Technologies, Hamadan University of Medical Sciences, Hamadan 6517838736, Iran

Abstract: Almost all cell types, either in vivo or in vitro, create extracellular vehicles (EVs). Among them are exosomes (EXOs), i.e., tiny nanovesicles containing a lipid bilayer, proteins, and RNAs that are actively involved in cellular communication, indicating that they may be exploited as both diagnostics and therapeutics for conditions like cancer. These nanoparticles can also be used as nanocarriers in many types of research to carry agents such as drugs. Plant-derived exosome-like nanoparticles (PENs) are currently under investigation as a substitute for EXOs formed from mammalian cells, allowing researchers to get beyond the technical constraints of mammalian vesicles. Because of their physiological, chemical, and biological properties, PENs have a lot of promise for use as nanocarriers in drug delivery systems that can deliver various dosages, especially when it comes to large-scale repeatability. The present study has looked at the origins and isolation techniques of PENs, their anticancer properties, their usage as nanocarriers in the treatment of different illnesses, and their antioxidant properties. These nanoparticles can aid in the achievement of therapeutic objectives, as they have benign, non-immunogenic side effects and can pass biological barriers. Time-consuming and perhaps damaging PEN separation techniques is used. For the current PEN separation techniques to be used in commercial and therapeutic settings, they must be altered. In this regard, the concurrent application of biological sciences can be beneficial for improving PEN separation techniques. PENs' innate metabolic properties provide them a great deal of promise for application in drug delivery systems. However, there could be a risk to both the loaded medications and the intrinsic bioactive components if these particles are heavily armed with drugs.Therefore, to prevent these side effects, more studies are needed to devise sophisticated drug-loading procedures and to learn more about the physiology of PENs.

Keywords: Plant, Exosome, Nanoparticle, Cancer

27.

The Potential role of exosomes in the treatment of psychiatric disorders: a mechanistic review

Pooneh Bathaei[1], Mitra mahmoodzadeh[2], Homa mahmoodzadeh[2*]

[1] Department of Pharmaceutical Biotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

[2] Department of Biology, Faculty of Science, Islamic Azad University, Mashhad Branch, Mashhad, Iran.

Abstract: Psychiatric disorders - a group of conditions disrupting an individual's behaviors, feelings and emotions, thoughts, and perceptions– are a growing concern affecting patients' daily basis. Current treatments for mental diseases vary from medications such as antidepressants, antipsychotics, and mood stabilizers to psychotherapy methods including cognitive behavioral therapy, exposure Therapy, etc., and hospitalization. Considerable side effects, lack of efficacy for all patients, and slow therapeutic response of Such approaches have led to searching for new alternatives. Exosomes are extracellular biovesicles filled with nucleic acids, proteins, and lipids, which are responsible for intercellular communication. Evaluating exosomes for their potential clinical applications is a relatively new topic worth attention. This review aims to investigate the probable mechanisms of exosomes in the treatment or alleviating the symptoms of mental illnesses. Although the exact cause of various psychiatric disorders is still unclear, it is believed that neuroinflammation, CNS homeostasis disturbance, neurotransmission disruption, abnormal brain structure, etc., are some of the known triggers of such diseases. Exosomes are confirmed to help maintain CNS normal function through possessing a regulatory effect on neurotransmitter levels, gene expression, inflammation, synaptic function and plasticity, and nerve regeneration, as well as being able to protect neurons from toxic oligomers, induce communication between neurons, and transfer various molecules and compounds in CNS. Furthermore, exosomes can cross the blood-brain barrier making them a meritorious exclusive drug carrier. In conclusion, it seems that exosomes are potentially effective compounds in the treatment and even diagnosis of mental disorders. However, more studies are required to prove the efficacy and safety of exosomes for such applications.

Keywords: exosomes, extracellular vesicle, therapeutic targets, mental disorder, psychiatric diseases, schizophrenia

28.

AI and VR: A Dynamic Duo in Pharmaceutical Science

Parsa Dokhani[1] , Niloofar Naghi Ganji[2] , Shabnam Aghababaei[3] , Mazda Rad-Malekshahi[4]

Department of Pharmaceutical Biomaterials, Faculty of Pharmacy, Tehran University of Medical Science, Tehran, Iran

Abstract(review): Utilizing Artificial intelligence in various fields of pharmaceutical sciences have received a lot of attention. With the advancement of virtual reality technologies, their integration with artificial intelligence can open new horizons to drug discovery, development and education in pharmaceutical science.

AI Applications:

Drug Discovery And Development : Potential applications in biological or genetic data analysis, drug discovery acceleration, and the identification of rare or selected molecules for example companies like Pfizer , Cerevel Therapeutics and Colossal Biosciences are using AI tools designed by Google for drug discovery.

Pharma Education: it can assist in pharmacy education by generating natural language explanations of pharmacology, pharmacokinetics, and drug interactions, providing examples and case scenarios, generating flashcards and quizzes, and linking to relevant resources.

Drug Delivery: Computational pharmaceutics, which strives to improve medication delivery processes by utilizing multiscale modelling methodologies, was developed as a result of the integration of AI and big data in the pharmaceutics area.

VR Applications:

Educational Purposes: Anatomical experiments and clinical trial data can be virtually designed for better understanding through deep learning.
Drug Development: simulation of complex biological processes, which can lead to more accurate and efficient drug development.
Drug Discovery: Virtual reality offers an immersive platform for visualizing complex molecular structures and simulating drug interactions, enabling researchers to make more informed decisions during the drug discovery process.

Utilizing VR and AI Together:

AI Based VR Experiments: many tests like HPLC can be practiced in a smart VR situation where AI Changes and sets the parameters.

Accelerated Drug Design and Discovery: Merging these technologies together will have synergic effect on the process of drug optimization, design and discovery.

AI Powered Education with VR Gamification and Quiz: Using machine learning to design Personalized Virtual Scenarios and Cases.

Probable limitations: Cost and resources to establish the facilities, ethical among other transparency and bias issues, as well as the copyright issues and also the possibility of inaccurate or misleading content.

Keywords: Artificial Intelligence, Virtual Reality, Pharmaceutical Science

29.

Chitosan a Potential Biomaterial as Drug Delivery in Inflammatory Bowel Disease Treatment

1st Bahareh Alizad

1. Department of Medical Laboratory Sciences, Paramedical Faculty, Urmia University of Medical Sciences, Urmia, IR

Abstract: Introduction: Inflammatory Bowel Disease is progressive infection that causes severe inflammation in the digestive tract by altering the intestinal Microbiome and down regulating the host immune system. It is classified into two group Crohn Disease and Ulcerative colitis. Also, environmental and genetic factors associated with IBD. Although various drugs such as corticosteroids; aminosalicylates; antibiotics are used for IBD. But some patient has experienced reduced efficacy and others suffered side effects. Therefore, Biomaterials in natural polymers group such as Chitosan are suggested. Chitosan is the N-deacetylated derivative of chitin that forms the exoskeleton of crustacean shells. Belongs to the polysaccharide family.

Methods: by searching keywords such as Inflammatory Bowel Disease_ Biomaterials _ Chitosan in database like PubMed; Google Scholar; SID from 2015 to 2024 information collected.

Results: Chitosan increase interaction with the negatively charched mucosal surface the Colon. Chitosan can form with single Ig domains containing the IL_6 receptors negatively regulate the toll-like-receptor signaling pathway. Therefore, it decreases IBD inflammation. If Chitosan coated by Eudragit ES100 and hyaluronic acid to form carries for tacrolimus; hydroxypropyl- cyclodextrin and this hyaluronic acid provide greater affinity to CD44 receptors. While Chitosan coated by Eudragit FS 30D sustained curcumin release under the Colonic PH environment. Rifaximin and Melatonin with Chitosan are used in ameliorating IBD inflammation.

Conclusions: natural polymers like Chitosan possess considerable encapsulation efficiency and can exhibit great PH dependence. Chitosan coated by tacrolimus is easily accessible and mesalamine with Chitosan has low toxicity and immunogenicity. However Inorganic material used via oral; IV and can Inherent ROS scavenging abilities. But there is potential toxicity at high dose and the mechanism of action of metallic particles needs to verified.

Keywords: Inflammatory Bowel Disease_ Biomaterial_ Chitosan

30.

Preparation and characterization of stimuli-responsive nanocomposite based on modified graphene and chitosan

1st Amirmohammad Bolhasani, 2nd Hossien Nazockdast, 3rd Reza Mahjub, 4th Alireza Mahjub

1. *Polymer and Color Engineering Department, Amirkabir University of Technology, Tehran, Iran*
2. *Polymer and Color Engineering Department, Amirkabir University of Technology, Tehran, Iran*
3. *Faculty of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran*
4. *Polymer and Color Engineering Department, Amirkabir University of Technology, Tehran, Iran*

Abstract: Stimulus-responsive hydrogels have gained significant attention in biomedicine for their hydrophilicity, biocompatibility, and three-dimensional structures. These hydrogels find applications in various domains, including controlled drug release, tissue engineering, wound healing, and more. Notably, the pH stimulus holds paramount importance as pH variations occur naturally in the human body. The network structures of hydrogels, owing to their low mechanical resistance, are inherently susceptible to deformation and size changes. Consequently, such alterations can lead to uncontrolled drug release or compromise the performance of the drug delivery system. To address these challenges, this study focuses on the utilization of graphene nanoparticles to enhance mechanical properties, drug loading capacity, and achieve controlled drug release. To enhance the biocompatibility of graphene in physiological environments, modified Hummers and Offman's method was utilized. Subsequently, they were incorporated into a chitosan/acrylic acid hydrogel composite. The composite hydrogel is synthesized through in-situ polymerization and chemically bonded, creating a strong connection between the components. The resulting chitosan/acrylic acid hydrogel composite possesses pH-responsive characteristics due to its inherent functional groups, enhancing mucosal adhesion and drug efficacy in the body. The dispersion of graphene oxide nanoparticles and the characterization of surface functional groups on the modified graphene nanosheets were analyzed using XRD and XPS tests and elemental analysis data. Subsequently, notable enhancements in mechanical properties were observed within the carrier matrix. Various analytical techniques, including FTIR, SEM and swelling studies were utilized to investigate the physical and chemical properties of the delivery system. Therefore, the composite hydrogel consisting of chitosan-grafted acrylic acid and graphene oxide nanosheets demonstrate enhanced drug delivery efficacy and controlled release capabilities within specific pH environments. This composite hydrogel holds significant potential as a promising candidate for targeted drug delivery systems.

Keywords: Stimuli-Responsive Hydrogels, Drug Delivery System, Mechanical Properties

31.

Porous particles functionalized with pH-responsive cell-penetrating peptide for Curcumin-targeted drug delivery

Ebrahim darvishi[1,2] , Zhila Izadi[2,3*]

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*
2. *Pharmaceutical Sciences Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran*
3. *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Extensive research has explored the potential anticancer properties of curcumin through various formulations, including nanoparticles and nanocomposites(1) . Despite its advantages, curcumin faces challenges such as rapid metabolism, limited absorption, and quick systemic elimination(2) .To address these issues and enhance its bioavailability, diverse strategies have been employed, with one notable approach involving the utilization of porous aerogels as drug delivery vehicles (3). Aerogels stand out due to their unique physical characteristics, boasting a high specific surface area, significant porosity, and solid composition that make them ideal candidates for drug delivery systems(4) .In a recent investigation, a pH-responsive aerogel was developed and assessed for targeted delivery of curcumin to colon cancer cells. Trehalose served as a coating agent to regulate curcumin release, while PLP (poly(L-lysine isophthalamide)) functioned as a targeted drug delivery facilitator known for enhancing cell permeability. Physicochemical analyses were conducted to compare the synthesized aerogel pre- and post-loading with curcumin and coating with trehalose(5) . Subsequent evaluation on HT29 colon cells via a cell bioavailability test demonstrated the successful creation of the aerogel featuring a porous structure with distinct cavities. The trehalose coating effectively controlled drug release at lower pH levels while enabling targeted release at the desired site(6) . The tailored curcumin-loaded porous particles functionalized with PLP exhibited promising efficacy by enhancing curcumin penetration into cells, suggesting their potential as a novel dual-effect drug carrier for cancer therapy. This innovative approach holds significant promise in addressing the challenges associated with curcumin delivery and maximizing its therapeutic impact in cancer treatment.

Keywords: Curcumin, Anticancer, Nanoparticles, Nanoparticles, Aerogels drug delivery systems, Bioavailability, Trehalose coating

32.

Synthesis of Quercetin@ZIF-8@PVA Nanofiber for Skin Wound Healing: An In-Vivo Study

Mahshid Hayati[1], Behrang Shiri Varnamkhasti[1], Hossein Derakhshankhah[1,2], Mohammad Hossein Farzaei[1], Zhila Izadi[1,2]

1.Faculty of Pharmacy, Kermanshah University of Medical Science, Kermanshah, Iran.

2. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Cutaneous wounds are prone to infection and cause serious problems for patients. Therefore, different kinds of wound dressings are available. Due to the defects of traditional wound dressings like gauzes and bandages which need frequent changes, can't provide a moisture environment and stick to the wounds that make it both painful and harmful to remove, therefore, the demands for a novel dressing have been increased. A PVA-based nanofiber loaded with Quercetin (QU) encapsulated into a Zeolitic imidazolate framework (ZIF-8) as a novel wound dressing is proposed and fabricated. Quercetin, a kind of flavonoid, has shown good effects on cutaneous wounds healing because of its antioxidant and anti-inflammatory properties. But low solubility and toxicity of high doses of Quercetin in wounds are a matter of concerns. By encapsulating Quercetin into a ZIF-8, a control release system is made, which prevents Quercetin burst release and the following toxicity in wounds. In addition, ZIF-8, a kind of metal organic frameworks, has unique features such as high porosity, high stability and antibacterial property, which make it a good candidate for drug delivery system in wound healing. The results showed that the PVA nanofiber containing zeolite nanoparticles loaded with Quercetin had suitable physicochemical properties. The drug release rate of about 80% in the first 168 hours of the study seems to be very suitable for not needing to change the dressing during the treatment period. The biocompatibility results showed that the synthesized nanofiber alone (ZIF-8@PVA) and together with quercetin (QU@ZIF-8@PVA) have good biocompatibility. The results of the animal study showed that the QU@ZIF-8@PVA group showed a significant improvement in wound healing compared to the negative control group. In addition, the results of antioxidant tests (catalase, glutathione and nitric oxide) showed a significant performance of the group receiving nanofibers with drugs (QU@ZIF-8@PVA) compared to the negative control group.

Keywords: Nanofiber, Zeolitic imidazolate framework, Quercetin, wound

33.

Investigation of affinity and interaction of fibrinogen with trehalose as a protein stabilizer

Kasra Khoshkalam[1], Zhila Izadi[2,3], Alireza Lotfabadi[2], Hossein Derakhshankhah[2]

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.*
2. *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.*
3. *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Trehalose, a substance with notable characteristics, is highly valuable in the field of biomedicine due to its anti-inflammatory properties and its ability to prevent scar formation at wound sites. This project is designed to investigate the interaction between trehalose and fibrinogen, a key protein in wound healing, with a focus on their structural properties. A variety of analytical techniques, including steady-state fluorescence, UV-Vis analysis, circular dichroism (CD), Zeta potential measurements, and Fourier-transform infrared spectroscopy (FT-IR), are used to study the impact of trehalose on fibrinogen. The results reveal that trehalose causes surface-related structural changes in fibrinogen, leading to its compaction. In addition, computational modeling techniques such as docking and molecular dynamics simulations are used to provide a deeper understanding of the interactions between trehalose and fibrinogen. The results suggest the formation of a stable complex between the two, with minor alterations in the protein structure as a result of the interaction. The primary forces driving the interaction between trehalose (the ligand) and the protein are hydrogen bonds and van der Waals forces, leading to an entropy-driven spontaneous interaction. FT-IR data shows the formation of new bonds between fibrinogen and trehalose following their interaction, while Zeta potential studies indicate that the interaction with trehalose increases the stability of the protein structure. Cytotoxicity tests performed on a standard fibroblast cell line reveal that the fibrinogen-trehalose complex exhibits reduced toxicity in comparison to trehalose by itself. This indicates a lesser adverse effect on cells by the complex. Furthermore, molecular docking analysis corroborates these experimental findings, showing that trehalose molecules predominantly attach to the C-terminal end of the coiled-coil segment and the globular region of the Bβ chain in the Dβ fragment. These results underscore the potential of trehalose as an effective material for wound dressing applications.

Keywords: Fibrinogen, Trehalose, Structure stabilizer, Ligand-protein, Cytotoxicity.

34.

Three-dimensional contact hydrogels containing antidepressant drugs for the treatment of depressive effects

Faeze Abbasi [1], Mahsa Abbasi [2], Milad Gholami [3*]

[1] Department of Biology, Basic of Sciences Faculty, Payame Noor Kermanshah, Kermanshah. Iran.
[2] Department of Chemistry, Basic of Sciences Faculty, Ilam University, Ilam, Iran.
[3] Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Ilam, Iran.

Abstract: Depression is a common mental illness that affects millions of people around the world. Traditional depression treatment usually involves antidepressants with severe side effects and low efficacy. To address these challenges, new drug delivery systems such as contact gel have emerged as promising alternatives. This summary will give an overview of the development and potential applications of contact hydrogels for antidepressants. Antidepressant contact hydrogels are three-dimensional polymer networks that can absorb and release antidepressants. These hydrogels are designed to be directly exposed to affected tissues to allow local delivery of drugs and improvement of therapeutic results. The choice of hydrogel materials and drug-loading strategies greatly influences the release movements, stability, and biocompatibility of the system. The development of contact hydrogels for antidepressants involves carefully considering several factors, including the mechanism of the gel, drug encapsulation technology, and drug release control. By integrating stimulant components into the hydrogel matrix, the drug can be released on demand, reacting to specific triggers such as pH changes, temperature changes, or enzyme activity, and enhancing the effectiveness of treatment. Local delivery of antidepressants by contact hydrogel has several advantages over traditional systemic drug administration. By minimizing systemic exposure, these hydrogels can potentially reduce the risk of systemic side effects associated with oral antidepressants. In addition, they provide accurate space and time control over drug release, allowing personalized therapy and reducing drug concentration fluctuations. These hydrogels have improved treatment results, reduced side effects, and improved patient compliance. Furthermore, the versatility of the contact hydrogel platform enables the simultaneous distribution of multiple drug or therapy combinations, allowing synergistic effects and personalized treatment strategies. Finally, antidepressant contact hydrogels are promising approaches to the delivery of local drugs for the treatment of depression. The ability to distribute drugs directly to the affected tissues remains unchanged.

Keywords: Contact Hydrogels, Antidepressant, Stimulants, Three-dimensional

35.

The effect of hydrogel containing turmeric (Curcuma longa) and egg white on burn wound healing in rats

Hamed Khorami *[1], Faezeh Abbasi [2], Milad Gholami [3], Mahsa Abbasi [4], Somayeh Bajelani [5]

[1] Department of medicinal chemistry, university of Guilan, Guilan, Iran.
[2] Department of Biology, Basic of Sciences Faculty, Payame Noor Kermanshah, Kermanshah. Iran.
[3] Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Ilam, Iran
[4] Department of Chemistry, Basic of Sciences Faculty, Ilam University, Ilam, Iran
[5] Department of computer engineering and information technology, Razi university, Kermanshah, Iran.

Abstract: A burn wound is a suitable place for resistant infections to occur. Therefore, research is necessary to find effective drugs and hydrogels against this infection. The present study was conducted to investigate the effect of hydrogel dressing containing turmeric and egg white on the healing of burn wounds (type 2) in rats. 30 rats were divided into 5 groups of 6 and studied. After general anesthesia with ketamine and xylazine (IP), a portion of the back of the mice was burned with a hot coin and similar second-degree burns were produced. The control group did not receive any drug. In the second group, the wound surface was covered daily with silver sulfadiazine. In the third group, the wound surface was covered daily with hydrogel containing turmeric extract and egg white. In the fourth group, the wound surface was covered daily with hydrogel dressing containing turmeric powder and egg white, and in the fifth group, the wound surface was covered daily with hydrogel containing fresh turmeric and egg white. Mice were killed by ether at the end of weeks 1, 2, 3, and 4, and the wound area was sampled and histologically evaluated. Then the samples were stained with hematoxylin and eosin and examined and studied. The results showed that after 4 weeks, burn wounds in the group receiving turmeric extract and egg white healed faster and better than other groups. The results showed that topical application of hydrogel wound dressing containing turmeric extract and egg white once a day improves second degree burn wounds. Almost similar results were observed in silver sulfadiazine group compared to turmeric extract and egg white group.

Keywords: Wound dressing, Hydrogel, Turmeric, Egg white.

36.

Targeting fibroblast activation protein (FAP): advances in CAR-T cell, antibody, and vaccine in cancer immunotherapy

Sedigheh shahvali[1], Niloufar Rahiman[2], Mahmoud Reza Jaafari[3], Leila Arabi[4]

1 Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

2. Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

3 Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract: Fibroblast activation protein (FAP) is a serine protease with dual enzymatic activities overexpressed in cancer-associated fibroblasts (CAFs) in several tumor types, while its expression in healthy adult tissues is scarce. FAP overexpression on CAFs is associated with poor prognosis and plays an important role in tumor development, progression, and invasion. Therefore, FAP is considered a robust therapeutic target for cancer therapy. Here, we try to review and highlight the recent advances in immunotherapies for FAP targeting including the anti-FAP antibodies and immunoconjugates, FAP chimeric antigen receptor (CAR)-T cell, and various FAP vaccines in a preclinical and clinical setting. Subsequently, a discussion on the challenges and prospects associated with the development and translation of effective and safe therapies for targeting and depletion of FAP is provided. We proposed that new CAR-T cell engineering strategies and nanotechnology-based systems as well as advanced functional biomaterials can be used to improve the efficiency and safety of CAR-T cells and vaccines against FAP for more personalized immunotherapy. This review emphasizes the immune targeting of FAP as an emerging stromal candidate and one of the crucial elements in immunotherapy and shows the potential for improvement of current cancer therapy. A summary of different immunotherapy approaches to target fibroblast activation protein (FAP) for cancer therapy.

Keywords: Cancer immunotherapy, Chimeric antigen receptor (CAR)-T cell therapy, Fibroblast activation protein (FAP), Monoclonal antibody, Targeting, Vaccine

37.

Virus-like particles: preparation, immunogenicity and their roles as nanovaccines and drug nanocarriers

Zakieh Sadat Hoseini[1], Saghi Nooraei[2], Howra Bahrulolum[2], Camellia Katalani[2], Abbas Hajizade[3], Andrew J Easton[4], Gholamreza Ahmadian[2]

1. Department of Medical Nanotechnology, Faculty of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran

2. Department of Industrial and Environmental Biotechnology, National Institute of Genetic Engineering and Biotechnology (NIGEB), Tehran, Iran.

3. Applied Microbiology Research Center, Systems Biology and Poisonings Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran

4. School of Life Sciences, Gibbet Hill Campus, University of Warwick, Coventry, UK.

Abstract: Virus-like particles (VLPs) are virus-derived structures made up of one or more different molecules with the ability to self-assemble, mimicking the form and size of a virus particle but lacking the genetic material so they are not capable of infecting the host cell. Expression and self-assembly of the viral structural proteins can take place in various living or cell-free expression systems after which the viral structures can be assembled and reconstructed. VLPs are gaining in popularity in the field of preventive medicine and to date, a wide range of VLP-based candidate vaccines have been developed for immunization against various infectious agents, the latest of which is the vaccine against SARS-CoV-2, the efficacy of which is being evaluated. VLPs are highly immunogenic and are able to elicit both the antibody- and cell-mediated immune responses by pathways different from those elicited by conventional inactivated viral vaccines. However, there are still many challenges to this surface display system that need to be addressed in the future. VLPs that are classified as subunit vaccines are subdivided into enveloped and non- enveloped subtypes both of which are discussed in this review article. VLPs have also recently received attention for their successful applications in targeted drug delivery and for use in gene therapy. The development of more effective and targeted forms of VLP by modification of the surface of the particles in such a way that they can be introduced into specific cells or tissues or increase their half-life in the host is likely to expand their use in the future. Recent advances in the production and fabrication of VLPs including the exploration of different types of expression systems for their development, as well as their applications as vaccines in the prevention of infectious diseases and cancers resulting from their interaction with, and mechanism of activation of, the humoral and cellular immune systems are discussed in this **review**.

Keywords: Cancer vaccine; Expression and purification platforms; Immune response; Infectious disease vaccine; Subunit vaccine; Virus-like particles (VLPs)

38.

Targeted delivery of curcumin to breast cancer cells using star-like polymers decorated with AS1411 aptamer

Rozita feizpour[1], Khalil abnous[2], Seyed Mohammad taghdisi[3]

[1]*Department of Medicinal Chemistry, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*

[2]*Department of Medicinal Chemistry, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*

[3]*Department of Pharmaceutical Biotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran*

Abstract: Breast cancer is a lethal disease that mainly threatens women's lives around the world and is considered a tough challenge in the field of oncology. Despite many efforts, the search for the best treatment for this type of cancer still poses a significant threat today. Since its inception, investigating the optimal treatment modality for this malignancy remains an ongoing pursuit. Utilizing natural compounds with lowered cytotoxicity towards non-cancerous cells offers a promising strategy for treating cancer. Curcumin is an inherent antioxidant with numerous advantageous properties. However, its poor bioavailability and inadequate water solubility prevent its application as an anti-cancer pharmaceutical agent. In order to solve the problems mentioned earlier, a novel strategy was designed using natural products. Novel 21-arm star-like diblock polymer of β-cyclodextrin-{poly (ε-caprolactone)-poly (2-aminoethylmethacrylate)} 21was synthesized through ROP with electron transfer atom transfer radical polymerization (ARGET ATRP) methods. Then β-CD-(PCL-PAEMA) 21 encapsulated with curcumin (Cur) by co-lyophilisation method. Afterward Cur@β-CD-(PCL-PAEMA)21 decorated with AS1411 aptamer. The chemical structure was verified through 1HNMR and FT-IR. SEM and DLS indicated that spherical nano micelles with a 145 ± 2.1 nm size and Zeta potential of – 19.5 mV were prepared. The LC and EE of Cur in the nanocomplex were 21% and 72%, respectively. Agarose gel electrophoresis confirmed that AS1411 aptamer could conjugate to the surface of Cur-β-CD-(PCL-PAEMA) 21-AS1411. *In vitro* drug release experiments exhibited approximately 45% of Cur released in 48h in acidic cancer environments. A cellular toxicity (MTT) assay was performed to analyze curcumin toxicity against 4T1 and MCF7. MTT assay indicated that the prepared micelles remarkably increased cell death in MCF-7 and 4T1 cells, while negative nucleolin cells (CHO) demonstrated high viability. Therefore, HA and FA ligands better target moieties to treat highly aggressive and metastatic MDA-MB-231 breast cancer cells using PLGA nanoparticles. Acquired results from the cytotoxicity assay indicated that AS1411 could act appropriately as a targeting agent.

Keywords: Breast Cancer, AS1411 aptamer, Curcumin

39.

Development of the hydrophobically modified quaterinized cellulose based nanovector for gene delivery

Parisa Mahdavi[1], Soheila Mohammadi[2], Leila Behbood[2], Ezzat Rafiee[3], Zahra Pourmanouchehri[2], and Zahra Moradi[3].

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*
2. *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*
3. *Faculty of Chemistry, Razi University, Kermanshah, Iran*

Abstract: Introduction: Gene therapy is one of the best alternatives to conventional cancer treatments, including chemotherapy and radiation therapy. one of the greatest challenges in gene therapy is the design of suitable carriers for the efficient gene transferring. Several viral and non-viral methods of gene transfer have been designed for human gene therapy, but both viral and non-viral carriers possess positive and negative characteristics. In this work, micellar nanocarrier based on hydrophobically modified quaterinized cellulose (HMQC) was investigated to transfer gene to eukaryotic cells.

Materials and Methods: Amphiphilic HMQC nanomicelles were successfully synthesized by introducing hydrophilic quaternary ammonium groups and hydrophobic hexadecyl groups to the hydroxyl groups of cellulose. HMQC nanomicelles were characterized by using zeta-potential measurement, DLS, FT-IR and TEM. Gene trapping by the synthesized nanomicelle was evaluated through gel retardation. Cytotoxicity and effectiveness of nanomicelles in EGFP gene transferring were measured by MTT method and fluorescence microscope to HEK293T eukaryotic cells, respectively.

Results: Based on the results of FT-IR analysis and also the positive zeta potential of nanoparticles, the synthesis of HMQC nanomicelles has been successfully carried out. The results of different ratios of DNA to HMQC nanomicelle, in the gel retardation assay, show that in all samples, DNA was adsorbed, which is probably because of the electrostatic interaction between the positively charged on the HMQC micelles surface and negatively charged phosphate groups on pDNA. However, in the 6:1 ratio of micellar nanocarrier to pDNA, the micellar nanocarrier completely adsorbed pDNA and this ratio was chosen for EGFP gene transferring into the HEK293T and HeLa cell lines. The results reveal the proper efficiency of HMQC micelles in the transfer of EGFP genes. Therefore, HMQC nanomicelles can be considered as an efficient, biocompatible, and degradable nanocarrier for gene therapy.

Discussion and Conclusion: It can be concluded for the first time that HMQC micellar nanoparticles can be a suitable gene carrier for gene therapy of various diseases.

Keywords: Gene delivery, non-viral vector gene, cellulose, quaterinized cellulose

40.

Co-loading of paclitaxel and selenium nanoparticles in nanofibers and in vitro evaluation of its skin anticancer activity

Mahtab Doostan[1], Maryam Doostan[2], Ata'ollah Rahmani Azar[3], Hassan Maleki[2,3]

1. Department of Medical Nanotechnology, School of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran

2. Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

3. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: The incidence of skin cancer has significantly risen over the last few decades, and traditional treatment approaches come with various constraints; As a result, there is a crucial need for the development of effective treatments. Thus, this research aimed to fabricate a nanofibrous scaffold using a combination of polycaprolactone (PCL) and chitosan (CS), loaded simultaneously with synthesized selenium nanoparticles (Se NPs) and paclitaxel (PTX) to prevent the growth of melanoma skin cancer cells.

Selenium nanoparticles were synthesized using chemical reduction method, and their size and morphology were analyzed. PTX:Se NPs PCL/CS nanofibers were produced and loaded through electrospinning, and their physicochemical characteristics were evaluated. Additionally, the release profile of the loaded compounds from the nanofibers was investigated. The toxicity and apoptosis activities were studied and assessed on melanoma cells using relevant methods.

The synthesized Se NPs exhibited dimensions in the nano-scale (around 120 nanometers) with a uniform and spherical morphology. The production of PCL/CS nanofibers loaded with both selenium nanoparticles and paclitaxel at 5% wt resulted in fibers with an average diameter of 35 ± 253, displaying a ribbon-like morphology and absence of droplets/beads. FTIR analyses confirmed the desirable lack of interactions between selenium nanoparticles and paclitaxel. The results indicated very high porosity, exceptional fluid absorption capacity, and complete wettability. The mechanical parameters obtained demonstrated the flexibility and high tensile strength of the produced nanofibers. Moreover, the release profile of the loaded compounds from the nanofibers exhibited a slow and continuous release over several days. Remarkably induced toxicity and higher levels of apoptosis were observed in melanoma cells treated with PTX:Se NPs PCL/CS nanofibers, attributed to the synergistic effects of Se NPs and PTX.

The results of this study indicate that PTX:Se NPs PCL/CS nanofibers can be employed as a promising non-invasive and targeted drug delivery system for effectively inhibiting the growth of melanoma skin cancer tumors.

Keywords: Skin cancer- Melanoma- Nanofibers- Se nanoparticles- Paclitaxel- Cytotoxicity

41.

In-situ Forming Biodegradable Implants for Sustained Fluocinolone acetonide Release to the Posterior eye: *In-vitro* and *in-vivo* investigations

Bizhan Malaekeh-Nikouei[1,2*], Malihe Karimi[1], Mojtaba Abrishami [3], Mehdi Farzadnia [4], Hossein Kamali[1]

1. Department of Pharmaceutics, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

2. Nanotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran

3. Department of Ophthalmology, Eye Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

4. Department of Pathology, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract: Delivering medication to the posterior segment of the eye presents a significant challenge. Intravitreal injection has emerged as the preferred method for drug delivery to this area. However, current injectable non-biodegradable implants for fluocinolone acetonide (FA) require surgical removal after prolonged drug release, potentially affecting patient compliance. This study aimed to develop an in-situ forming biodegradable implant (ISFBI) optimal formulation containing PLGA504H and PLGA756S (50:50 w/w%) with the additive NMP solvent. The goal was to achieve slow and controlled release of FA over a two-month period with lower burst release, following a single intravitreal injection. Through morphology, rheology, stability and in-vitro release evaluations, the optimal formulation demonstrated low viscosity (0.12-1.25 Pa.s) and sustained release of FA at a rate of 0.36 µg/day from the third day up to two months. Furthermore, histopathology and *in-vivo* studies were conducted after intravitreal injection of the optimal formulation in rabbits' eye. Pharmacokinetic analysis demonstrated mean residence time (MRT) of 20.02±0.6 days, half-life (t1/2) of 18.80±0.4 days, and clearance (Cl) of 0.29±0.03 ml/h for FA in the vitreous humor, indicating sustained and slow absorption of FA by the targeted retinal tissue from vitrea over the two-month period and eliminating through the anterior section of the eye, as revealed by its presence in the aqueous humor. Additionally, FA exhibited no detection in the blood and no evidence of systemic side effects or damage on the retinal layer and other organs. Based on these findings, it can be concluded that in-situ forming injectable biodegradable PLGA implants can show promise as a long-acting and controlled-release system for intraocular drug delivery.

Keywords: In situ forming implant; Fluocinolone; Sustained release; Ocular drug delivery

42.

Zwitterionic polymer brush coating decorated with Vancomycin to prevent catheter associated-infections

Maryam Hassani [a*], Seyed Mojtaba Daghighi [b], Ismaeil Haririan [a]

a Department of Pharmaceutical Biomaterials, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

b Pharmaceutical Sciences Research Center, Tehran Institute of Pharmaceutical Sciences (TIPS), Tehran University of Medical Sciences, Tehran, Iran

Abstract: A critical problem with the use of biomaterial implants is associated with bacterial adhesion on the surface of implants and in turn the biofilm formation. Among different strategies that have been reported to resolve this dilemma, surface design combined with both antiadhesive and antimicrobial properties has proven to be highly effective. Physiochemical properties of polymer brush coatings possess non-adhesive capability against bacterial adhesion and create a niche for further functionalization. The current study aims to evaluate the effect of antibiotics incorporated into the polymer brush on bacterial adhesion and biofilm formation. Brushes made of zwitterionic polymers were synthesized, functionalized with vancomycin via both physical and chemical conjugation, and grafted onto the silicon rubber surfaces. Antibacterial and antiadhesive measurements of designed coated biomaterials were mediated through the use of a parallel plate flow chamber against biofilm growth developed by Staphylococcus aureus and Escherichia coli over a period of 24 h. The study investigated the impact of antibiotics incorporation on antibacterial properties of surfaces coated with polymer brushes. We showed that antibacterial properties of surfaces coated with polymer brushes composed of zwitterionic polymers in an appropriate ratio gain highest efficacy against bacterial biofilm formation. Polymer brush coatings, when incorporated with the right antimicrobial agent, have the potential to effectively reduce the formation of biofilms. Nonetheless, the growth of biofilms on surfaces coated with zwitterionic brushes and functionalized with antibiotics could potentially arise from the distortion of the brush structure once antibiotics are linked to the functional groups of the brushes. The results of this study offer that non-adhesive surface designs in which the incorporating of antibiotics into the zwitterionic brushes should induce minimum distortion in the structure of brushes, regardless of the incorporation method. However, it is essential to emphasize that the phenomenon of deformity in brushes is currently speculative and requires further scientific investigation for confirmation. In addition, further investigations are needed to clarify the impact of incorporated antibiotics on the antiadhesive properties of zwitterionic brush based- coatings in combination with antimicrobial release and contact-killing functions in order to reduce the risk of biomaterial-associated infection.

Keywords: Zwitterionic brush, Antiadhesive, Biomaterials, Bacterial biofilms, Antibacterial surfaces, Bacterial adhesion.

43.

Photo-chemo-immunotherapy of Cancer Using Bi_2S_3-incorporated Hydrogel Enhanced with Cancer Cell Membrane and Sorafenib

Samin Abbaszadeh[1], Vahideh Nosrati[2], Kiyan Musaie[3], Mohammad Reza Eskandari[4], Mohammad-Ali Shahbazi[3]

1. Department of Pharmacology and Toxicology, School of Pharmacy, Urmia University of Medical Sciences, Urmia, Iran
2. Department of Pharmaceutical Biomaterials, School of Pharmacy, Zanjan University of Medical Science, Zanjan, Iran
3.Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Netherlands
4. Department of Pharmacology and Toxicology, School of Pharmacy, Zanjan University of Medical Science, Zanjan, Iran

Abstract:

Aim and Background: Bi_2S_3 nanorods (NRs) are promising photothermal agents for cancer therapy due to their light-to-heat conversion ability to induce apoptosis in tumor cells. Combination of PTT with chemotherapy and immunotherapy has a high potential to increase the chance of cancer eradication without metastasis to other vital organs. In this work, cancer cell-membrane (CCM) and sorafenib (SFN) were loaded into a photoactive injectable hydrogel to render tumor-specific immunotherapeutic function and chemotherapy to the prepared hydrogel.

Methods: Bi_2S_3 NRs were prepared using a simple chemical reaction and coated with hyaluronic acid to form BiH NRs. An injectable hydrogel was prepared via chemical crosslinking and incorporated with BiH NRs, CCM, and SFN. The physicochemical characterization and photothermal performance of the NRs and hydrogels, in vivo toxicity, the antibacterial activity, and its anti-cancer effect were evaluated on a 4T1 tumor-bearing mouse model.

Results and discussion: The rod shape nanoparticles, with an average particle size of about 57 nm were successfully loaded into the chemically crosslinked hydrogel, which had good injectability. BiH NRs demonstrated sufficient temperature elevation to kill cancer cells after 10 min of near-infrared (NIR) irradiation. In addition, the BiH-loaded hydrogel showed potent antibacterial activity. The combined intratumoral photo-chemo-immunotherapy demonstrated more anticancer effects than the individual photo-, chemo- or immunotherapy alone.

Conclusion: In this study, an injectable hydrogel containing BiH NRs, CCM, and SFN is reported for cancer ablation via a synergistic effect. In addition, the injectable hydrogel had the capability to load drugs for sustained release at the cancer tissues over a long period.

Keywords: Injectable Hydrogel, Photothermal therapy, Chemotherapy, Immunotherapy, Breast cancer

44.

Novel Design and Synthesis of a Bifunctional Compound for Treating Parkinson's Disease via Targeted Protein Degradation

Roshanak Amirian [a,b,c,1], Hossein Derakhshankhah [b,c,2], Zhila Izadi [b,c,3]

a Kermanshah University of Medical Sciences, Kermanshah, Iran
b Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran
c USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: In crafting the blueprint for heterobifunctional molecules engineered to orchestrate targeted protein degradation (TPD), with a specific aim of mitigating the deleterious effects of Parkinson's disease (PD) in its advanced stages, a meticulously refined approach is imperative.

PD poses a challenge, in medicine specifically in its subsequent stages when conventional therapies often fall short. The core issue in PD involves the buildup of alpha-synuclein, known as oligomers and fibrils leading to nerve cell impairment. Alpha-synuclein oligomers disrupt the electrophysiological properties of neurons and dopamine release. Furthermore, their accumulation results in the deposition of insoluble fibrils within neurons, causing damage to the intracellular cleaning system, including the autophagy-lysosome pathway, as well as organelles such as mitochondria and the endoplasmic reticulum (ER). In this article, we present an approach aimed at tackling this situation by designing extraordinary molecules tailored for treating PD. Our method integrates bifunctional molecules which are unique as they can simultaneously bind to different ligands. We select two types of extraordinary molecules; derivatives of curcumin and inhibitors of alpha-synuclein which are connected by a linear linker. Leveraging the abilities of curcumin derivatives targets LC3II proteins in the inner membrane of the autophagosome to trigger autophagy, a cellular process that degrades misfolded proteins. Additionally, our designed alpha-synuclein inhibitors interact with alpha-synuclein clusters virtually precluding their formation and spread. The creation of this complex molecule results in an autophagosome-targeting compound (ATTEC) for eradicating alpha-synuclein clumps, that can specifically break down alpha-synuclein oligomers and fibrils within the autophagic environment. Through design and extensive testing, we show the impressive effectiveness of ATTEC in improving alpha synuclein-related issues in *SH-SY5Y* cells and animal models with advanced PD. The rise of ATTEC marks a change, in how PD is treated with a focus on straightforward and targeted strategies to address the root causes at a molecular level. As we approach the transition to applications the promise of ATTEC as a treatment option is evident bringing newfound optimism, for those facing the complicated issues posed by advanced stages of PD.

Keywords: Targeted Protein Degradation (TPD), ATTECs, Parkinson’s Disease, Alpha-synuclein

Tissue engineering & regenerative medicine

45.

The Role of Biomaterials and Decellularized Tissues in Enhancing Skin Regeneration: A Literature Review

1st Yasaman Naghibzadeh[1], 2nd Arshia Javadizadeh[1], 3rd Leila Rezakhani[2]

[1]*Students Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*

2. *Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: The skin is a crucial organ of the human body that encases the body and plays a significant role in safeguarding and enhancing aesthetic qualities. The significant demand for a method to assist in the repair of skin injuries arises from the fact that the skin has the inherent ability to fully recover on its own. For this purpose, the tissue engineering technique is an appropriate approach specifically decellularized tissues. The utilization of materials or structures derived from decellularized tissue offers several advantages. Firstly, these materials are well-tolerated by the immune system, minimizing the risk of rejection. Additionally, they contain beneficial substances that promote the regeneration process, making them a superior alternative to conventional treatments such as xenograft or allograft for skin graft procedures. Recent studies indicate that marine decellularized tissue and its extracellular matrix (ECM) contain appropriate biomaterials for skin tissue regeneration due to being a hopeful source of collagen. It is self-evident that collagen plays a crucial role in the skin structure and its healing process. Marine collagen sourced from *Basa fish* skin has been utilized in the creation of a bio-ink for the advancement of extrusion 3D bioprinting in order to produce a bilayered skin model. Decellularizing the skin of different fish species (like *Tilapia*, and *Baza fish*) or marine by various strategies can be a remarkable base to make scaffolds or structures for the purpose of skin regeneration. For example, using a scaffold containing *brown alga*-derived polysaccharide (BAP) and polyvinyl alcohol (PVA) has the potential to significantly contribute to the process of wound healing on the skin by affecting vessel regeneration and controlling inflammation. An additional illustration, a scaffold based on *Korean Amberjack* decellularized extracellular matrix (dECM) after adding hyaluronic acid hydrogels can be used to repair skin. Additional research is necessary to investigate further studies focused on determining the most suitable scaffold and tissue sourced from marine organisms for the purpose of skin regeneration.

Keywords: Materials, Marine, skin Regeneration, Tissue Engineering

46

.

Mesenchymal Stem Cell-Derived Extracellular Vesicles: A Potential Therapeutic Strategy for Acute Kidney Injury and Chronic Kidney Disease; A Review

1st Niyaz Gharooni, 2nd Zahra Ghafari, 3rd Zahra Hooshmand, 4th Ahmadreza Aminian*

1,2,3. *Student Research Committee, Arak University of Medical Sciences, Arak, Iran*

4. *Iran Department of Physiology, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran*

Abstract: Acute kidney injury (AKI) remains conventionally described as a quick failure of renal purpose and a chief clinical problem, that clinically establishes as an upsurge of creatinine and urea, connected with water homeostasis and disturbance of salt. There is an indication that still a solitary part of AKI disposes the kidney to a reaction to injury causes advanced disfunction and develops of chronic kidney disease (CKD). There is motionless an absence of exact and useful treatments for AKI, although stem cell relocation is hopeful. Indeed, more than a few reports offer undoubted indication of the recreating ability of EVs liberated by stem cells and, especially, mesenchymal stromal cells (MSCs) in diverse kidney damage replicas. We observed PubMed, Google Scholar and other Databases. We also reviewed these articles and collected the necessary information. Initial consequences recommend that MSCs are safe, well tolerated, and competently better renal pathology. MSCs spread over their reparative belongings by discharging EVs, and current several tests have established the advantages of MSCs into curing AKI, and countless techniques of increasing the outcome of MSCs have arose recently. Extracellular vesicles (EVs), a kind of vesicles of membrane including lipids, active proteins, and diverse kinds of genetic material (mRNAs, miRNAs, and DNAs associated with the features of the creating cell). EVs freed of MSCs rapid proteins included in the MSCs self-regeneration and diversity and the nucleic acid arrangement classic for MSCs. EVs disconnected with MSCs develop quickly a possible cause in management of kidney damages. As much as their foundation, in the early revisions, investigators utilize EVs took from bone marrow MSCs (BM-MSCs) and noticed the retrieval of the cell propagation, damaged renal tubular cells, and apoptosis reserve through the AKI persuaded by glycerol inoculation example, and that fortified them to manage more revisions, having some examples of CKD and AKI. The helpful results of EVs- originated from MSCs, throughout the progression of AKI, are connected with their anti-fibrotic, anti-apoptotic, and immunomodulatory capabilities. studies have exposed that MSC-derived EVs offer an in effect new treatment choice for these kinds of patients.

Keywords: Acute kidney injury (AKI), Chronic kidney disease (CKD), mesenchymal stromal cells (MSCs) , Extracellular vesicles (EVs)

47.

Acceleration of Healing Infected Wounds Based on Alginate/α-Pinene Hydrogel in mice model

Nasrin Kakaei[1, 2*], Veria Naseri[2], Abbas Ahmadi[2,3]

1. *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*
2. *Department of Research and Development, Jiran Pharma Company, Sanandaj, Iran*
3. *Cellular and Molecular Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran*

Abstract: One of the most common bacteria in infected wounds in recent years is Staphylococcus aureus (S. aureus), which has grown significantly. Alginate hydrogel has been used as a durable, biocompatible, and water-absorbing coating directly to treat wounds. Its high permeability to oxygen is one of its advantages, which accelerates the wound healing process. However, it does not have a significant effect on the healing of infectious wounds that are associated with chronic inflammation and infection. Therefore, to solve this challenge in the last decade, monoterpene compounds that have a strong antibacterial effect have attracted more attention. Although the antibacterial and anti-inflammatory effects of α-pinene (monoterpene) have been studied in various studies, they have not been studied much in the field of wound dressings and the healing of infected wounds. α-Pinene embedded in alginate hydrogels has been prepared and identified by using of FT-IR and SEM spectroscopy. The minimum inhibitory concentration (MIC) of the hydrogel against S. aureus was determined by microdilution method. The cytotoxicity of the samples was evaluated by the MTT assay. In vivo, the wound in the dorsal surfaces of mice was induced with S. aureus bacteria and treated over a 13-day period. The synthesis of alginate hydrogel was confirmed using physicochemical methods. The results of the MTT test showed the non-toxicity of COS7 cells in the Alg/α-pin incubation compared to the control group. In addition, when the leukocyte count was compared between the treated and control mice, the leukocyte count was significantly lower in the treated mice than in the control mice. Evaluation of the wound healing index indicated a healing rate of 94%, which was significantly higher than the 74% in the group without α-pin. The study results demonstrated that the alginate hydrogel containing α-pin accelerated wound healing through antibacterial effects. Therefore, it is promising to improve the properties of alginate for healing chronic infectious wounds in preclinical studies.

Keywords: Wound Healing, α-Pinene, Alginate, Infection

48.

Synthesis and characterization of scaffolds containing liposomal nanoparticle of curcumin for diabetic wound healing

Neda Mostajeran[1,2], Mahmoud Reza Jaafari[1,2], Marzieh Mohammadi[1,2]

1. Nanotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran

2. Department of Pharmaceutical Nanotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract: Diabetic ulcers are the main cause of amputation in patients with diabetes. The main cause of poor healing of these wounds is still unknown, but it can be related to poor angiogenesis caused by ROS and neuropathy. In our study, curcumin was used to investigate the effect of angiogenesis. The initial stages of work include designing, manufacturing and evaluating the efficiency of wound dressings made of nanofiber containing the slow release liposomal formulation of curcumin as an anti-inflammatory and angiogenesis stimulating agent. Liposomal formulations were prepared and characterized. Liposomes were evaluated in terms of size, zeta potential, encapsulation percentage, release properties and morphology. In the next step, nanofibers were prepared. Physicochemical properties of nanofiber dressing were investigated by FTIR, NMR, GPC, tensile strength and stability studies, rheology, SEM, DSC. Then liposomal nanoparticles were placed in the nanofiber structure and the release rate of curcumin was studied. In the next stage of the study, in order to achieve the appropriate concentration of curcumin, and to obtain the best concentration for angiogenesis, an angiogenesis test was performed on eggs in different concentrations of curcumin. The results showed that curcumin has the most angiogenesis at a concentration of 90 µM.

Keywords: Curcumin, Diabetic wounds, Angiogenesis, Nanofiber, Anti-inflammatory

49.

Incorporation of diatom within the 3D biopolymer scaffolds for bone tissue engineering

Mina Mohammadi[1], Narges Poursina[2], Mohammad-Ali Shahbazi[3], and Mohammad Reza Eskandari[4]

[1]Department of Pharmaceutical Biomaterials, School of Pharmacy, Zanjan University of medical Science, 45139-56184 Zanjan, Iran.
[2]Department of Pharmaceutical Biomaterials, School of Pharmacy, Zanjan University of medical Science, 45139-56184 Zanjan, Iran.
[3]Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Antonius Deusinglaan 1, 9713 AV Groningen, The Netherlands.
[4]Department of Toxicity, School of Pharmacy, Zanjan University of medical Science, 45139-56184 Zanjan, Iran

Abstract: The main goal of this study is to introduce and construct a polymer hybrid scaffold in combination with Diatoms as a bioactive compound with osteogenesis capability for use in bone tissue engineering. The combination of biopolymers, including gelatin (GEL), chitosan (CS), and hyaluronic acid (HA), and alongside diatom (Di), is used to produce GEL/CS/HA/Di scaffold by freeze-drying method. All scaffolds were evaluated for their physicochemical properties, including morphological characteristics by SEM, porosity measurement, and cross-linking reaction by FTIR, and TGA. Moreover, other physicochemical properties of scaffolds such as biocompatibility, water absorption ability, mechanical strength, and biomineralization were investigated. In order to determinate the toxicity and osteogenesis of the scaffolds in the body environment, creating a hole in the tibia of the rat, the placement and repair process of the scaffolds were monitored during 7 weeks by radiology, Micro-CT images, and Histology. Polymeric scaffold obtained with covalent bonds have the characteristics of biocompatibility, absorb water, and interconnected pore. The incorporation of Di within the composite contributes to the average microscopic pore size of 240 μm, the adjustment of porosity (90.2% to GEL/CS/HA and 50.0% to GEL/CS/HA/Di) and degradation, as well as increased Young's modulus up to 19.0 MPa for the scaffold with Di. Micro-computed tomography and X-ray radiology evaluations confirmed that a high new bone tissue density formed in the defect site during 7 weeks of GEL/CS/HA/Di scaffold implantation. Furthermore, *in vivo* toxicology studies showed a non-toxic effect of GEL/CS/HA/Di scaffolds on the blood biochemical and hematological parameters. This scaffold possesses a uniform structure, biodegradability, biocompatibility, desirable porosity and mechanical, interconnected pores, all of which needed for effective of bone repair. *In vivo* studies have confirmed the safety of the scaffold and its potential to stimulate the creation of new bone tissue. This is achieved by providing an osteoconductive platform for cell attachment, prompting calcification, augmenting the proliferation of osteoblasts, and presenting anti-inflammatory properties.

Keywords: Scaffold, Diatom, Osteogenesis, Biomineralization, bone tissue engineering

50.

Biomimetic Mineralized Bone blocks based on Bio glass/hydroxyapatite and gelatin methacrylate (GelMA) for bone tissue repair and regeneration

Mahsa Abbasi [1, 2], Zhila Izadi [2,3*]

[1] *Department of Chemistry, Basic of Sciences Faculty, Ilam University, Ilam, Iran.*

[2] *Pharmaceutical Sciences Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

3. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: The goal of bone tissue engineering is to induce new functional bone regeneration through the synergistic combination of biomaterials, cells and therapeutic factors. Bio glass hydroxyapatite is a bioactive ceramic material that closely resembles the mineral component of natural bone. This material is known for its excellent biocompatibility and osteoconductivity that promotes bone regeneration. Synthesis of HA bio glasses based on Ti or Si have emerged as a promising strategy to increase their mechanical properties and bioactivity. This composite material is compatible with the human body and binds to soft tissues and bones, and stimulates new bone growth. On the other hand, Gelatin methacrylate (GelMA) is one of biomaterials that showed an important role in the field of tissue engineering and biomedicine due to its biocompatibility, tunable mechanical properties, and ability to wing potential, facilitate cell adhesion and proliferation. Fabrication of bio glasses -polymer composite based on HA and gelatin methacrylate (GelMA) can be an attractive bone blocks for bone repair and regeneration. Hence, considering the high demand for three-dimensional (3D) scaffolds for the treatment of bone regeneration defects, the use of bio glass-polymer composite can be a suitable choice. Bio glasses materials and polymers separately require certain basic properties to expand their usefulness. Be that as it may, the programming of polymer and BG composites guarantees that they have progressed properties that make them adaptable materials for bone tissue designing applications.

Designing these structures using new technologies such as 3D printers with the features that these biomaterials offer may be an ideal choice for a wide range of bone complications for orthopedic surgeons.

Keywords: Hydroxyapatite bio glass, Methacrylate gelatin (GelMA), Bone blocks, 3D printer.

51.

Synthesis and characterization of water-soluble polyphosphazene and its cross-linked polymer with Ti as bone tissue engineering scaffold: in vitro and in vivo evaluations

Mahnaz Mohammadpour[1], Sadegh Hasannia[2], Hossein Derakhshankhah[3,*], Hadi Samadian[4], Khodayar Gholivand[1,*]

[1] *Department of Chemistry, Faculty of Sciences, Tarbiat Modares University, Tehran,* Iran

[2] *Department of Biochemistry, Biological Science, Tarbiat Modares University, Tehran, Iran*

[3] *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[4] *Research Center for Molecular Medicine, Hamadan University of Medical Sciences, Hamadan, Iran*

Abstract: The current research focuses on the introduction of a biocompatible and water-soluble polyphosphazene called polypropylene glycol phosphazene (PGP) and its cross-linked polymer with titanium (PGP-Ti). PGP was synthesized through ring-opening polymerization of hexachlorocyclophosphazene and binding of propylene glycol to P atoms. Polymer chains were crosslinked through hydrothermal reaction using titanium (IV) butoxide as crosslinker. PGP and PGP-Ti were carefully analyzed using known techniques of ^{1}H and ^{31}P-NMR, XRD, FTIR, DSC, TGA, FESEM/EDX, cyclic voltammetry and zeta potential measurements. These studies showed that the synthesis of polymers was well performed. The structure of PGP-Ti polymer and pattern of HOMO and LUMO orbitals were predicted using DMol^3 module based on DFT-D in Materials2017 studio software. Also, hydroxyapatite - as a bone replacement material - was synthesized by a modified method and its properties were characterized. C2C12 and L929 cell proliferation by MTT assay and C2C12 cell differentiation by alkaline phosphatase activity assay showed increased proliferation and osteoblastic differentiation in the presence of PGP. This polymer also showed good antibacterial activity against E. coli bacteria. The ability of PGP as a polyol osmolyte was evaluated by measuring the lysozyme aggregation, as a model protein, by DLS in the presence of PGP. The aggregation of lysozyme decreases with increasing PGP concentration in the solution, and therefore the stability of proteins increases. Cell viability of PGP-Ti as biomimetic scaffold cultured with C2C12 and L929 cells compared to hydroxyapatite was measured. furthermore, PGP-Ti polymer was injected as an implant in mice living tissue, which histological evaluations using Hematoxylin-Eosin and Masson trichrome stain showed weak immunogenicity. In vitro and in vivo evaluations confirmed remarkable cell and tissue-compatibility of PGP-Ti polymer, and this polymer could be a promising material for bone tissue engineering applications.

Keywords: Alkaline phosphatase, Hematoxylin-Eosin stain, Masson trichrome stain, Polyphosphazene, Hydroxyapatite.

52.

Evaluation of graft polymer based on polyorganophosphazene containing polycaprolactone as tissue engineering scaffold using experimental and theoretical approaches

Mahnaz Mohammadpour[1], Hadi Samadian[2,*], Hossein Derakhshankhah[3], Khodayar Gholivand[1,*]

[1] *Department of Chemistry, Faculty of Sciences, Tarbiat Modares University, Tehran, Iran*

[2] *Research Center for Molecular Medicine, Hamadan University of Medical Sciences, Hamadan, Iran*

[3] *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: This work was conducted with the aim of synthesis an appropriate scaffold composed of polycaprolactone (PCL) and polyorganophosphazene (PGP), with a focus on the possibility of its use in tissue engineering applications. The ring opening polymerization (ROP) of e-caprolactone by the PGP as a multisite initiator and the successful synthesis of PGP-g-PCL graft polymer was verified by the requisite tests including FESEM-EDS, FTIR, NMR, DSC, TGA and contact angle. The molecular geometry and energy of PGP-g-PCL was calculated using Perdew–Burke–Ernzerh, Grimme method and Basis set; DND; 3.5 (similar to 6-311G*). Surface energy calculations of orbitals showed that HOMO and LUMO orbitals of polymer distributed on P and O atoms connected to P and CH3 linked to the O atom. Besides this, MD simulations were performed to understand the interaction of polymer with phospholipid membrane, and the energy negative amounts of the interactions indicates the stability of the polymer-membrane system. compatibility and interfaces between synthetic polymers and C2C12 and L929 cells were evaluated by MTT and FESEM, respectively. obtained results was displayed high proliferation rate, enhanced cell adhesion and excellent cell viability on the scaffold. After that, Biocompatibility of polymer with living tissue was studied through intraperitoneal implantation of its prepared parts in Balb/C mice. Analysis of pathology results exhibited no signs of necrosis, inflammation and infection, while in vivo degradation, new bone formation and osteogenesis were seen. in vitro and in vivo assessments show that the PGP scaffold possess superior biocompatibility and more prominent biological behavior compared to pure PCL. This better quality is attributed to the higher hydrophilicity of the new polymer scaffold, which leads to greater cell adhesion and proliferation. Herein, we rendered evidence that affirms the effective performance of PPGP-g-PCL polymer in tissue engineering applications.

Keywords: Polyphosphazene; Polycaprolactone; Tissue engineering scaffold; In vitro and in vivo studies.

53.

Enhancing Bone Regeneration: Controlled Release System of Rosuvastatin via PCL/Gelatin Scaffolds for Tissue Engineering

1st Maliheh Gharibshahian, 2nd Majid Salehi, 3rd Morteza Alizadeh*

* *The name of the author who presents the abstract should be listed first and underlined.

1. *Department of Tissue Engineering and Applied Cell Sciences, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran.*

2. Department of Tissue Engineering, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

3. Department of Tissue Engineering, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

Abstract: Rosuvastatin (RSV) is the longest half-life hydrophilic statin effective on osteoblast differentiation and bone regeneration, which often its oral use leads to insufficient bioavailability in low doses and rhabdomyolysis, hepatic injury, and nausea in high doses. This investigation aims to engineer polycaprolactone (PCL)/gelatin scaffolds loaded with different concentrations of RSV (0.5 mg/10ml, 2.5 mg/10ml, 12.5 mg/10ml) and evaluate their effects on compressive strength, drug release profile, morphology, biocompatibility, contact angle, degradation rate, blood clotting index, and alkaline phosphatase (ALP) activity of scaffolds. The Thermally Induced Phase Separation (TIPS) method was used for the fabrication of the scaffolds, the umbilical cord-derived mesenchymal stem cells were used for cellular evaluations, and the Fourier-transform infrared spectroscopy (FTIR) method was used to evaluate the surface functional groups of the scaffolds. The results showed that adding up to 2.5mg/10ml of RSV improved cell survival. The compressive strength, degradation rate, wettability, blood clotting index, and ALP activity of scaffolds increased with increasing RSV concentration so that PCL/Gelatin/ 12.5mg/10ml RSV scaffolds had compressive strength, degradation rate, wettability, and blood clotting index equal to 14.264 ± 2.1 MPa, 16.2%, 82.3 degree, and 38.4% respectively. During 30 days, stable release of RSV from the PCL/Gelatin/ 2.5mg/10ml RSV scaffolds was observed (only 37%), which indicated the potential of these scaffolds as a release system. Overall, our results showed that PCL/Gelatin/RSV 2.5mg/10ml scaffolds with sustained RSV release provided a new approach for bone regeneration.

Keywords: Rosuvastatin, Bone tissue engineering, drug delivery, polycaprolactone

54.

Green synthesis of *Urtica dioica* mediated silver nanoparticles for enhanced wound healing

Mehdi Sahranavard[1], Habib Ghasempour[1], Mohammad Hossein Armand[1], Esmaeel Sharifi[2], Meysam Soleimani[1,*]

[1] Department of Pharmacy, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran

2 Department of Tissue Engineering, School of Advanced Technologies in Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

3 Department of Biotechnology, School of Advanced Technologies in Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

Abstract: This study intends to investigate the wound recuperation properties of synthesized silver nanoparticles (AgNPs) using Urtica dioica aqueous extract. Silver-containing dressings have been used in clinical settings to deal with various casualties, consisting of burns, chronic wounds, pemphigus, and poisonous epidermal necrolysis. Simultaneously, Urtica dioica extract exhibits mighty anti-inflammatory and antimicrobial results, which could synergize favorably with silver for wound recuperation. The synthesized AgNPs were characterized by the usage of dynamic mild scattering (DLS), Zeta Potential determination, UV-Vis spectroscopy, FT-IR, X-ray diffraction (XRD), discipline emission scanning electron microscopy (FE-SEM), electricity dispersive X-ray spectroscopy (EDX). The first sign of synthesis of AgNPs was seen by way of the yellowish-brown shade of the answer, the UV-vis showed the synthesis of AgNPs with the peak at 450 nm, and DLS analysis proved an average hydrodynamid diameter of 62.82 nm for the silver nanoparticles. In vitro, studies were accomplished to analyze the antioxidant pastime of the samples with the resource of the DPPH assay. In addition, the antimicrobial activity of the pattern is examined against gram-positive and gram-negative microorganisms through an antibacterial assay. The samples were also tested for blood compatibility and cytotoxicity using the MTT assay. These checks were conducted to decide the suitability of the model for its applicability in various settings. The prepared nanoparticles, showed antioxidant, and hemocompatible properties, without toxicity. Collectively, these in vitro experiments provide strong evidence that the silver nanoparticles derived from *Urtica dioica* extract are well-suited for wound healing applications due to their elevated antioxidant properties.

Keywords: Wound dressing, Green synthesis, Silver nanoparticules, *Urtica dioica*, anti-inflammatory

55.

Effect of boron nitride nanotubes structure on encapsulation and release process of gemcitabine, using molecular dynamics simulation

Maryam Shirzad [a], Seyed Majid Hashemianzadeh [b]

a Nanotechnology Research Center, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

b Molecular Simulation Research Laboratory, Department of Chemistry, Iran University of Science and Technology, Tehran, Iran

Abstract: In this work we have investigated the encapsulation of anti-cancer gemcitabine drug and fullerene (C60) molecule inside pristine and defective boron nitride nanotubes (BNNTs) such as stone-wales boron nitride nanotube (SWBNNT) and di-vacancy boron nitride nanotube (DV-BNNT). Moreover, the release process of encapsulated gemcitabine molecule from open-ended nanotube by fullerene molecules were checked out using molecular dynamics simulations. According to the results of encapsulation of drug and fullerene molecules inside of BNNTs, both of gemcitabine and fullerene molecules tend to be encapsulated in all three types of BNNT such as pristine and defective nanotubes. In the case of release process, results revealed that release from pristine-BNNT is slower than defective BNNTs which is due to the stronger interaction between drug cytosine group and nanotube wall. However, SW and DV defects in the nanotube structure motivate faster release rather than the previous case. Furthermore, results demonstrated that SW-BNNT is better carrier for drug encapsulation and release due to the less interaction energy and high movement tendency of drug and C60 molecules inside of SW-BNNT.

Keywords: Boron nitride nanotube, defect, gemcitabine, encapsulation, release, molecular dynamics simulation.

56.

Bionic Skin: Exploring the Revolutionary Advancements in Artificial Skin Technology

Maryamosadat Mavaei [1], Zhila Izadi [2,3], Alireza Lotfabadi [2]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran
2. Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran
3. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Recent years have seen wonderful development in the field of artificial skin system, resulting in the making of bionic skin (BS), which nearly resembles the characteristics and abilities of human skin. In the effort to produce artificial skin that is more practical and realistic, BS marks a major advancement. Scientists have created new biomaterials and/ or technologies that successfully mimic the intricate structure and sensory characteristics of human skin. BS can now display characteristics like elasticity, stretchability, self-healing, and even touch, pressure, and temperature perception thanks to these developments. BS has enormous potential to improve the capabilities of robotic systems in the field of robotics. By integrating artificial skin with robots, BS enables robots to have a sense of touch, enabling them to handle delicate objects, interact safely with humans, and perform complex tasks with increased dexterity and precision. BS has the potential to completely transform artificial limb functionality and user experience in the prosthetics field. By embedding sensors in the artificial skin, prosthetic limbs can sense and sends sensory information to the user, allowing them to experience a sense of touch and better control their movements. Furthermore, BS has great implications in healthcare and biomedical applications. It can be utilized for the development of smart wound dressings that can monitor the healing process in real-time, early detect infections, and then deliver targeted medicine. They can also be used to make advance bandages, which offer ongoing vital sign assessment, allowing for quick intervention and diagnosis of health problems. In conclusion, scientific improvement toward mimicking the features and abilities of human skin has been accomplished in the scope of bionic skin. This technology can be used in a wide range of scopes, including robotics, prosthetics, and medicine. Bionic skin offers an engaging and lifelike interface between humans and robots, which could revolutionize industries and enhance the lives of a great number of people. Continued research, innovation and collaboration, in this field will cover the way for a future where artificial skin is indistinguishable from its biological counterpart.

Keywords: Bionic Skin, Artificial Skin, Robotics, Prosthetics, Healthcare, Sensory Perception

57.

Polyvinyl alcohol/Polyamide antibacterial electrospun nanofibers for treating burn wounds

Morteza Abazari[1], Safa Momeni Badeleh[2]

1. Department of Pharmaceutical Nanotechnology, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran.

2. Department of Food and Drug Control, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran.

Abstract:

Aim and Background

Bacterial infection of wounds delays healing process, turns them into chronic wounds and even leads to life-threatening complications and death. Currently, the clinical strategies for treating infectious and chronic wounds are limited. Therefore, efficient therapeutic methods are necessary to increase antibacterial abilities and improve wound healing simultaneously. Hence, nanofibrous scaffolds can be suitable candidates to be studied as wound dressings. Silver ions play an important role in several physiological processes, including angiogenesis, growth factor induction, and extracellular matrix remodeling, that modulate wound healing and tissue repair. Moreover, the enhanced antibacterial activity of silver nanoparticles (AgNPs) could alleviate the microbial burden of wounds and enhance wound healing process by shortening the inflammation phase duration. This study aims to enlighten the effect of AgNPs on wound dressing scaffolds as an antibacterial and skin tissue engineering.

Methods

PVA/PA composite nanofibers containing various concentrations of AgNPs and hemostatic agents were fabricated by the electrospinning method. XRD, FT-IR, SEM, Swelling, and Degradation analysis were used to analyze the physicochemical characteristics of the samples. Moreover, the antimicrobial, hemostatic, and wound-healing activity of AgNPs-loaded nanofibers were tested in vitro and in vivo.

Results and discussion

This research demonstrated that nanofibrous scaffolds were in the best form in the SEM and proved the high physicochemical and biocompatibility of the developed nanofiber mats in physicochemical analysis. Moreover, the excellent hemostatic, antibacterial, and wound-healing properties of the nanofiber in an aseptic environment at the wound site suggest their suitability as a sustained antibacterial wound dressing biomaterial.

Conclusion

Overall, the findings of this study support the idea that electrospun nanofibers can be used as effectual skin dressing scaffolds because their antibacterial, hemostatic and wound-healing properties can facilitate tissue regeneration and modulate wound healing.

Keywords: Silver Nanoparticles-Electrospinning- Nanofiber- Antibacterial-Wound healing.

58.

Proposing the most similar multi-layer biocomposite to natural tissue for dura mater regeneration

1st Mohammadmehdi Monazah[1,2], 2nd Leila Rezakhani[3]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

3. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Traumatic brain injuries, craniotomy surgeries, and infections are the most common potential causes of dura mater defects, and the selection of the most effective substitute is an important challenge for neurosurgeons. One of the most noticed substitutes is multi-layered biocomposites, which can mimic the mechanical and chemical characteristics of natural tissue and overcome the restrictions of individual component materials with the lowest post-surgical immunological complications. Composite materials, blend natural and synthetic polymeric materials. Research on different options for repairing the dura mater is still in the initial phases, but in 2020 compared to 2010-2020, a 33 relative percentage increase in studies happened on composite substitutes. Researchers in various fields have been led to conduct many studies to design the best biocomposite. Our aim of the present review is to examine the articles that have studied the probable mimics' close characteristics for the fabrication of dura mater regeneration.

Based on the current research findings, PLA, PGA, PLGA, PGC, PEG hydrogel, quaternized guar gum have positive features in preventing CFS leakage, alginate hydrogels, bacterial cellulose, collagen, chitosan, fibrinogen, gelatin, human amniotic membrane, and silk fibroin, quaternized guar gum have the best biocompatibility features, Gelatin, and chitosan have the best dural reconstruction mimcers, Chitosan, oxidized quaternized guar gum, and antibiotic-loaded sheets like vancomycin have antibacterial effects, PLGA, freeze-dried gelatin, PLA, PLLA, collagen, PCL, utilizing drug loaded sheets or physical barriers are anti-adhesive methods. Besides, the disadvantages of layers should be covered by the advantages of the closed layer.

According to various studies, dura mater injuries should be regenerated based on age, area of injury, cause of injury, personalized features, and surgeon experience, especially regarding post-surgical complications. This variation is achievable by utilizing the fabrication of multi-layered biocomposites.

Keywords: Biocomposite, Tissue engineering, Cerebrospinal fluid, Extracellular matrix, Dura mater.

59.

What is the best choice of decellularized biological scaffold for dura mater regeneration?

1st Mohammadmehdi Monazah[1,2], 2nd Leila Rezakhani[3]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

3. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Neurosurgeons face a problem in selecting the most suitable alternative for dura mater regeneration in certain clinical situations such as traumatic brain injury or craniotomy procedures, aiming to minimize post-surgical complications. Decellularization of xenograft tissues is a cost-effective and well-accepted method in clinical use. Decision-making relies on factors such as age, damage etiology, defective surface, and the patient's medical conditions. Because of being one layer of these substitutes and having less changeable characteristics compared to Multi-layered biocomposites, they should be like natural tissue to mimic the natural dura, biomechanically, especially Young's modulus and tensile strength, chemically, and in terms of suitable biocompatibility. This review research attempts to analyze the literature to identify similar properties of potential mimics for creating dura mater regeneration in various conditions.

Based on the current research findings, in the area aspect**,** biological grafts were more often used in infratentorial defects. Besides, the total complication rate was like allografts and synthetic, but separately, the rate of chemical meningitis and pseudomeningocele was significantly higher with nonautologous grafts. Preclinical and clinical research focuses on non-human extradural tissues to regenerate non-human or human dural tissues, including Porcine small intestine submucosa, tendon, pericardium, peritoneum and dermis, Equine pericardium, Porker’s dura, swim bladder, and Fish skin. Human products include the amniotic membrane and the human dermis.

Our study suggests that dura mater injuries should be repaired under certain conditions, and all substitutes yielded positive outcomes in patients, and there is no priority differentiated between them in the literature. Future studies should examine histological traits, post-surgical side effects, and in vitro properties of substitutes to determine the most suitable option for each condition. Also, enhancing the decellularization and characterization processes is crucial to reduce issues.

Keywords: Decellularization, Tissue engineering, Cerebrospinal fluid, Extracellular matrix, Dura mater.

60.

Revolutionizing the Future of Cartilage Tissue Repair: An Investigation of Poly ethersulfone Scaffold Manufacturing Methods and Performance

Mohammad Eini[1,2], Shaghayegh Doudi[3,4], Niloofar Taghipour[1,5*], Simzar Hoseynzadeh[1*], Amir mahdavi[6]

1. Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

2. Student Research Committee, School of Medicine, Shahid beheshti University of Medical Sciences, Tehran, Iran

3. Student Research Committee, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

4. Department of Tissue Engineering, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran.

5. Medical Nanotechnology and Tissue Engineering Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

6. Departemant of mechanical engineering, shahrood university,iran

Abstract: Cartilage damage is a type of joint disease that gradually destroys the protective joint cartilage, eventually affecting the subchondral bone, making the patient's condition more difficult. In the United States, around 31 million people experience joint diseases, which destroy cartilage and bone tissue, leading to limited mobility, joint swelling, stiffness, and chronic pain. It is estimated that by 2030, approximately 67 million adults in the United States alone will have symptoms of osteoarthritis. Due to the increase in the average age of Iran's population, along with the prevalence of diseases, joint injuries, and sports injuries, cartilage defects have become a major concern.

These defects often result in disability, pain, discomfort, and reduced quality of life. To address this issue, Polyethersulfone polymer (PES) has been used in biomedical applications such as hemodialysis, filtration, and ultrafiltration. PES is known for its positive biological properties, including high glass transition temperature and chemical resistance. It is also relatively low in flammability, water absorption, and dielectric loss. Polymer-based three-dimensional structures have excellent bioactivity properties, which leads to an increase in the proliferation, differentiation, and penetration of embryonic stem cells. Hempen further enhances the differentiation and penetration potential of stem cells. These structures are not cytotoxic and can be maintained without losing their desirable properties. Moreover, these structures can cultivate cells in a 3-dimensional and biodegradable manner, and this property remains intact even after six months.

The three-dimensional scaffold made of PES has a semi-permeable membrane and a pore system, providing a large internal surface area that facilitates cell migration and attachment. Due to its wide network of interconnected pores, polyethersulfone polymer enables extensive contact between cells, making it a promising biomaterial for use in tissue engineering. However, compared to other synthetic polymers, fewer studies have been conducted on its biocompatibility properties. In this study, we aim to review authoritative articles in the field of tissue engineering, focusing on the physical, chemical, and biological properties of polyethersulfone polymer. We will explore the methods for making scaffolds and repairing tissue using this biomaterial, with a specific focus on its potential for cartilage tissue repair.

Keywords: Poly ethersulfone, Tissue engineering, Gela, Cartilage, Biomaterial.

61.

Scrophularia striata -mediated silver nanoparticles for enhanced wound healing

Mohammad Hossein Armand[1], Meysam Soleimani[2], Esmaeel Sharifi[3, *]

[1] Department of Pharmacy, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran

2 Department of Biotechnology, School of Advanced Technologies in Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

3 Department of Tissue Engineering, School of Advanced Technologies in Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

Abstract: Due to the various medical benefits of natural plants, the use of plant extracts as wound healing has become widespread. The purpose of this experiment was the green synthesis of silver nanoparticles (AgNPs) from the aqueous extract of *Scrophularia striata* and to investigate their wound healing properties. Physicochemical and structural characteristics of silver nanoparticles synthesized were measured using different microscopic techniques including UV-Vis spectroscopy, dynamic light scattering (DLS), determination of zeta potential, FT-IR, X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX), field emission scanning electron microscopy (FE-SEM). The presence of silver nanoparticles was confirmed through FE-SEM along with EDX analysis. According to DLS analysis, 73.93 ± 10.52 nm was measured for the average size of silver nanoparticles. Also, the optimal ratio of extract to silver nitrate solution was obtained and the optimal size was calculated as 52.85 nm. The negative value of zeta potential confirmed the stability of silver nanoparticles. Furthermore, the EDX results confirmed the synthesis of AgNPs by showing a strong signal in the silver region. Next, antioxidant (DPPH), antibacterial (MIC), hemocompatibility and cytotoxicity (MTT) tests were performed, as well as *in vitro* wound healing assessment. According to the aforementioned assays, the results of this work showed that green synthesized silver nanoparticles was biocompatible, and have promising performance for wound healing. The formulation of silver nanoparticles with the extract of *Scrophularia striata* showed proper antioxidant and antibacterial activity. The green synthesized AgNPs by use of aqueous extract of *Scrophularia striata* was suggested as an eco-friendly nanomaterial for combating infectious wounds.

Keywords: Wound healing, green synthesis, silver nanoparticles, Scrophularia striata

62

Optimizing the structure of hydrogel composite scaffolds with experimental design method and in vitro study to induce angiogenesis in tissue engineering

Maria Valadbeigi[a], Mina Habibizadeh*[a], Mahmoudreza Moradi[a,b], Kamran Mansouri[c]

[a]*Regenerative Medicine Research Center (RMRC), Kermanshah University of Medical Sciences, Kermanshah, Iran*

[b] *Urology Department in Imam Reza General Hospital and Chairman of Regenerative Medicine Research Center (RMRC), Kermanshah University of Medical Sciences, Kermanshah, Iran*

[c]*Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Tissue engineering is a reliable method to overcome tissue damage by mimicking the physiological microenvironment. In the process of tissue repair, angiogenesis as a biological event is very crucial to support the transport of oxygen and nutrients to improve the function of cells as well as to dispose of waste products. This is because if the cells are more than 100-200 micrometers away from the nearest blood vessel, they die due to lack of oxygen and nutrients. Therefore, in tissue engineering, to strengthen and accelerate the formation of blood vessels, a significant effort has been made to optimize 3D scaffolds in terms of pore structure and physical and chemical properties.

In this study, an optimized scaffold for use in tissue engineering with angiogenesis capability has been constructed and characterized. To maximize cell adhesion, proliferation, and migration while also introducing an angiogenesis capability, different conditions of the experiment were considered using the experimental design method, with structural variables involved. Therefore, first by defining the variables affecting the size, porosity, and morphology of the hydrogel scaffolds (made of chitosan, heparin, and pectin polysaccharides) in the Design Expert software space, we designed the test conditions in vitro studies.

In conclusion, the SEM images of the scaffold in optimal conditions have demonstrated a proper morphology with uniform honeycomb pores. Also, the survival and proliferation of human umbilical vein endothelial cells in the optimized scaffolds had a significant difference compared to the rest of the groups. These results indicated the capability of this type of engineered scaffold in creating angiogenesis and its greater efficiency in regenerative medicine.

Keywords: Tissue engineering, Hydrogel scaffold, Angiogenesis.

63.

Role of Exosome-loaded Decellularized Tissue in Regeneration Medicine

Leila Rezakhani[1,2*]

1. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Mesenchymal stem cell-derived exosomes (MSCs-EXO) have received a lot of interest recently as a potential therapeutic tool in regenerative medicine. Extracellular vesicles (EVs) known as exosomes (EXOs) are crucial for cell-cell communication throughout a variety of activities including stress response, aging, angiogenesis, and cell differentiation. Exploration of the potential use of EXOs as essential therapeutic effectors of MSCs to encourage tissue regeneration was motivated by success in the field of regenerative medicine. EXOs have been administered to target tissues using a variety of methods, including direct, intravenous, intraperitoneal injection, oral delivery, and hydrogel-based encapsulation, in various disease models. Despite the significant advances in EXO therapy, various methods are still being researched to optimize the therapeutic applications of these nanoparticles, and it is not completely clear which approach to EXO administration will have the greatest effects. Here, we will review emerging developments in the applications of EXOs loaded into decellularized tissues as therapeutic agents for use in regenerative medicine in various tissues.

Keywords: Exosome, Decellularized Tissue, Regenerative Medicine, Tissue Engineering

64.

wound healing with resveratrol loaded decellularized pericardium

Leila Rezakhani[1,2*]

1. *Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

2. *Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: The creation of skin tissue engineering scaffolds to aid in wound healing is one of the main goals of regenerative medicine. These scaffolds, with their structural emulation of bodily tissues, offer a novel perspective on the treatment of skin injuries. One can offer a platform that is appropriate for cellular processes. by naturally occurring scaffolds that preserve the essential elements despite being formed of decellularized tissues. Wound healing is also aided by resveratrol (RES), which possesses properties such as angiogenesis, antioxidant, antibacterial, and anti-inflammatory. In this study, decellularized sheep pericardium scaffolds loaded with RES were produced and examined on mouse models with full-thickness wounds. The in vivo results demonstrated that the groups receiving treatment with decellularized pericardium (DP) exhibited greater angiogenic and anti-inflammatory material production, as well as improved wound healing compared to the control group. The macroscopic and histological findings confirmed that the RES-loaded decellularized pericardium (DP-RES) secreted more of these factors than the scaffold without RES. Therefore, more study and preclinical testing might be done on the application of decellularization scaffolds containing materials like RES for the regeneration of skin wounds.

Keywords: Wound healing · Resveratrol ·Decellularization · Angiogenesis · Anti-inflammatory

65.

Biodegradable and thermosensitive hybrid nanohydrogel scaffold enriched with growth factor for cartilage regeneration: development, characterization, and in vitro evaluation

1st Fereshteh Valipour[1,3,4*], 2nd Ferzane Valioglu[2*], 3rd Soodabeh Davaran[1,3], 4th Reza Rahbarghazi[4]

1. *Applied Drug Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*
2. *Department of Molecular Biology, Faculty of Science, Hacettepe University, Ankara, Turkey*
3. *Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran*
4. *Department of Applied Cell Sciences, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran*

Abstract: Articular cartilage, has a limited ability to self-repair and regeneration owing to a lack of blood vessels and low cell density. To circumvent these pitfalls and limitations, cartilage tissue engineering is the great hope of repairing cartilage defects and injuries. In this approach, the combination of cells, scaffolds, and growth factors could improve the functionality of cells after transplantation to the target sites. Hydrogels are promising systems for cartilage tissue engineering due to their tissue-like and tunable physico-chemical properties. In the present study, we aimed at fabricating a novel biodegradable and thermosensitive hybrid polyester-polyacrylate nanohydregel scaffolds as a supportive matrix to promote the chondrogenic differentiation of human adipose-derived stem cells (hADSCs) that may serve as implantable reparative cells, all in the presence of the therapeutic platelet-derived growth factor. Physicochemical characteristics of scaffold such as chemical structure of copolymer, swelling behavior, lower critical solution temperature (LCST), hydrolytic degradation, mechanical properties and as well as scaffold morphology and cytotoxicity have been studied. LCST value of synthetized hydrogels was determined similar to *in vivo* body condition. According to scaning electron microscope micrographs, scaffold has nanoparticulate structure with particle size dimensions about 75 ± 5 nm. The viability of cells was investigated using the MTT assay. Cell viability study of hADSCs cultured on scaffold showed no cytotoxicity after 14 days. Finally, a real-time RT-PCR analysis demonstrated that the combination of hybrid polyester-polyacrylate nanohydregel scaffold and platelet-derived growth factor promoted the chondrogenesis of hADSCs over a period of 14 days by up-regulating the expression of aggrecan, type-II collagen, SOX9, and integrin β1 compared with the non-treated control group. These results demonstrate that the hybrid polyester-polyacrylate hydrogel scaffold carrying platelet-derived growth factor as a matrix for hADSCs cell seeding is a valuable system that may be used in the future as a three-dimensional construct for implantation in cartilage injuries.

Keywords: Thermoresponsive hydrogel, Biodegradable scaffold, Mesenchymal stem cells, Cartilage regeneration

66.

Novel Colorectal cancer spheroid model to evaluation of drug response

Fatemeh Makalani [1,2*], Ali Ghanbari, [3] Cyrus jalili [4], alborz jafaei [2]

[1] *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

[2] *Department of Anatomical sciences, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[3] *Department of Anatomical sciences, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

[4] *Department of Anatomical sciences, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

Abstract:

Background and Objectives: Drug resistance to conventional treatments is the primary issue with colorectal cancer (CRC), the second most common and deadly kind of cancer in the world. It is essential to develop more comprehensive models for more efficient treatments so 3D cultures spheroids contain a variety of different cellular phenotypes including quiescent cells, proliferating cells, and necrotic cells, which may be responsible for how the cells respond differently to treatment in 2D versus 3D. CRC spheroids represent a 3D avascular model of CRC that encapsulates cell-cell and cell-matrix interactions. Some of the main methods for scaffold-free spheroid formation include the hanging drop method, non-adherent surface culture, and gravity based systems, although AggreWell system consists of a high-density array of pyramid-shaped microwells, into which a suspension of single cells is centrifuged that makes use of a centrifugal forced aggregation technique and a micropatterned culture surface to guide the formation. this technique permits production of large numbers of uniform spheroid.

Methods: The information of this review study was obtained from key words in published scientific data bases: Science Direct, Web of Science, Pubmed, Iran medex

Results: 3D spheroid models are becoming more and more crucial for the study of cellular interactions that take place in the TME of CRC in vivo investigation. A reproducible spheroid model is essential to assess cellular interactions, CRC progression, as w ell as drug discovery. 3D spheroid models with aggrewell plate to investigate the appropriate cellular and drug response that can provide reliable and predictive knowledge about the in vivo efficiency of the modeling

Conclusion: In this review, we provide an overview of CRC 3D models for formation spheroids this system is suited to the generation of large numbers of uniform and reproducible tumor spheroids for the assessment of the effectiveness of novel antitumor agents or basic biological investigations.

Keywords: 3D models, colorectal cancer, drug resistance, spheroids, aggrewell

67.

The Role of Different Types of Smart Biomaterials in Regenerative Medicine

Fatemeh Sarami Foroushani[1], Simzar Hosseinzadeh[2], Mousa Kehtari[1], Mohamad Eini[2], Fatemeh Sadat Sharifnia[1]

1. Department of Animal Biology, Faculty of Biology, Tehran University, Tehran, Iran

2. Department of Tissue Engineering, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Science, Tehran

Abstract: Biomaterials are substances, either natural or man-made, that interact with biological systems. They are used in regenerative medical and tissue engineering to repair, support, or replace damaged tissue or improve special biological functions. Recently, the use of smart biomaterials has emerged as a promising field that could revolutionize the way we treat diseases and injuries. So that, Future advances in tissue engineering and regenerative medicine will depend on the development of smart biomaterials that actively participate in the formation of functional tissue. Functional and smart biomaterials have controllable properties and can alter their properties' capacity in response to an outside stimulus or from within the environment around them such as temperature, pH, light, magnetic or electric field, ionic factors, and biological molecules. Due to their biological properties and smart responsiveness, they show promising potential in various regenerative medicines, including wound treatment, tissue culture, targeted therapy of diseases, tissue regeneration, drug delivery systems, Immuno-engineering, biosensing, etc. There are various types of smart materials, namely piezoelectric materials, shape memory polymers or alloys, temperature-responsive polymers, photomechanical materials, self-healing materials, and thermoelectric materials. Several polymers are commonly used as smart biomaterials due to their tunable properties and responsiveness to external stimuli. In this review, we will examine the various types of biomaterials that are used to create smart biomaterials. We will also explore different strategies that can be employed to add smart capabilities to composite biomaterials. Additionally, we will study recent advancements in the smart composite biomaterials that are being used for tissue engineering in various organs. Finally, we will discuss the techniques used to fabricate these smart composite biomaterials.

Keywords: Tissue engineering, Smart biomaterials, Regenerative medicine

68.

Role of nanoclay-based biomaterials in regenerative medicine

Fatemeh sadat sharifnia[1], Simzar hosseinzadeh[2], Mousa Kehtari[1], Fatemeh sarami[1], Mohamad Eini[2]

1. Department of Animal Biology, Faculty of Biology, Tehran University, Tehran, Iran

2. Department of Tissue Engineering, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Science, Tehran

Abstract: Clays have been used in human civilization for medicinal purposes since 2500BC. Clay nanomaterials are layered structure particles consisted of silicate that have been widely used in regenerative medicine due to its biocompatibility, ease of manufacturing, non-toxicitiy, high specific surface area and high mechanical properties. These clays can be classified into four major groups: the kaolinite group (zeolite or halloysite), the montmorillonite/smectite group, the illite group, and the chlorite group. Today, clays are used in a wide range of medicinal applications such as bone tissue engineering, drug delivery, wound healing as hemostatic agents and enzymes immobilization. The silicate base and surface reactivity of nanoclay interact with the scaffold materials, ECMs or intracellular signaling pathways leading to stimulation and differentiation of cells. In regenerative medicine, composite scaffolds composed of polymers and various nanoparticles like nanoclay have emerged as potential materials in regenerative medicine. In bone tissue engineering, the combination of synthetic scaffold with different percentages of nanoclay affects the surface properties of scaffolds such as topography, surface charge, wetabillity, roughness and has an effective consequence on cell behaviors such as adhesion and differentiation without any osteogenic growth factors. Clay nanoparticles have been shown to increase the solubility of drugs that are less soluble and for increasing drug release. In addition, nanoclays have been explored for wound healing to prevent infections, scars and pain reduction.

Considering the importance of this nanoparticle, this study presents the structure, types and properties of nanoclays and illustrate the potential of nanoclay-based biomaterials to produce viable and functional constructs for regenerative medicine.

Keywords: Nanoclay, Regenerative medicine, Biomaterial

69.

Innovative Delivery of Copper Ions by Hydroxyapatite Nanoparticles: Potential Application in Bone Tissue Engineering

Alireza Noori [1,2], Mahdieh Hoseinpour [2], Sedighe Kolivand [3], Nasrin Lotfibakhshaiesh [2]*

1Department of Tissue Engineering and Applied Cell Sciences, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran.

2Department of Tissue Engineering, School of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran. 3Recombinant Proteins Department, Breast Cancer Research Center,

3Motamed Cancer Institute, ACWCR , Tehran, Iran.

Abstract: As a mineral component of bone, hydroxyapatite (HAp) nanoparticles—with the molecular formula Ca10(PO4)6(OH)2—are of great interest in bone tissue engineering. The hydroxyapatite structure allows the addition of ions like Zn, Ba, Sr, Co3, and Cl, which can enhance its mechanical properties, bioactivity, and biocompatibility. This study examines the impact of substituting copper for calcium in HAp. Hydroxyapatite nanoparticles were synthesized using the coprecipitation method, with varying concentrations of 1%, 3%, and 5% copper replacing calcium in the structure. XRD analysis indicated that the copper substitution was insufficient to form a distinct phase but led to a slight decrease in lattice parameters and crystallinity. Moreover, degradation tests showed that copper inclusion in hydroxyapatite doubled the release of calcium ions in water. Antibacterial assays demonstrated that a 200 mg/ml concentration of hydroxyapatite with 5% copper effectively eradicated E. coli and S. aureus bacteria. Additionally, copper enhanced the biocompatibility of hydroxyapatite. Alkaline phosphatase activity and alizarin red tests indicated that copper in hydroxyapatite did not impede stem cell differentiation into osteoblasts. Furthermore, scratch tests revealed that extracts of copper-infused hydroxyapatite promoted HUVEC cell migration. In summary, our results underscore the advantages of incorporating copper into hydroxyapatite, including improved antibacterial properties, biocompatibility, and angiogenesis.

Keywords: Hydroxyapatite, Copper, Antibacterial properties, Angiogenesis, Bone Tissue engineering

70.

Application of Nano-Bioengineered Mesenchymal Stem Cells for Targeting Glioblastoma Cancer Stem Cells: a narrative review

1st Atieh Raoufi, 2nd Prof.Abdolreza Esmaeilzadeh*

1. Department of Medical Immunology, school of Medicine, Zanjan University of Medical Science, Zanjan, Iran

2. Department of Medical Immunology, school of Medicine, Zanjan University of Medical Science, Zanjan, Iran

Abstract: Glioblastoma (GBM) is the most aggressive and deadly type of brain cancer, with a five-year survival rate of only 6%. Its resistance to conventional therapies is partly attributed to the presence of cancer stem cells (CSCs), a subset of cells within the tumor mass that contribute to tumor initiation, progression, and recurrence. Recently, mesenchymal stem cells (MSCs) have emerged as a promising tool for targeted cancer therapy due to their tumor-tropic migratory properties and ability to be easily engineered to carry therapeutic payloads. Moreover, the incorporation of nanotechnology into MSC-based cancer therapy has allowed for the improvement of the therapeutic efficacy and specificity.

In this narrative review, we provide an overview of the latest advancements in the application of nano-bioengineered MSCs for targeting GBM CSCs, focusing on the underlying molecular mechanisms and the potential clinical applications. First, we define the problem of GBM CSCs and the rationale for targeting them. Then, we discuss the current strategies for engineering MSCs with nanoparticles, including the selection of appropriate nanomaterials, functionalization methods, and cargo loading. Following this, we review the recent studies that have employed nano-bioengineered MSCs for targeting GBM CSCs, highlighting their therapeutic efficacy and safety profile. Lastly, we identify the current challenges and future directions in this rapidly evolving field, including the need for standardized protocols, improved biocompatibility, and larger-scale production.

Our review reveals that nano-bioengineered MSCs hold great potential as a novel strategy for GBM CSC-targeted therapy. Several studies have reported successful suppression of GBM CSC growth, invasion, and angiogenesis using nano-bioengineered MSCs. However, several challenges remain, including the lack of standardized protocols for MSC isolation, characterization, and engineering, as well as concerns regarding their potential tumorigenicity. Future studies should focus on addressing these challenges, as well as exploring the feasibility of using nano-bioengineered MSCs in combination with other therapies for GBM treatment.

In conclusion, the application of nano-bioengineered MSCs for targeting GBM CSCs represents a promising direction for GBM therapy. While significant progress has been made in recent years, further research is required to fully realize the potential of this approach and improve the outcome of GBM patients.

Keywords: Glioblastoma, Cancer stem cells, Mesenchymal stem cells, Nanoparticles, Targeted therapy, Regenerative medicine.

71.

Mesenchymal Stem Cell-Derived Exosomes Impacting Treg Populations and Alleviating Multiple Sclerosis Disease Progression: Narrative Review

1st Atieh Raoufi, 2nd Davood Jafari*

1. Department of Medical Immunology, school of Medicine, Zanjan University of Medical Science, Zanjan, Iran

2. Department of Medical Immunology, school of Medicine, Zanjan University of Medical Science, Zanjan, Iran

Abstract:

Objective: Investigating the influence of mesenchymal stem cell (MSC)-derived exosomes on regulatory T cells (Tregs) and their potential to treat multiple sclerosis (MS) carries significant implications. Current MS therapies primarily rely on broad immune suppression, which often leads to undesirable side effects. Targeted interventions focusing on specific immune cell types, including Tregs, might prove to be more efficient and safe. Understanding the interaction between MSC-derived exosomes and the immune system could pave the way for developing innovative cell-free therapeutics for diverse autoimmune disorders.

Results: Several studies have reported that MSC-derived exosomes positively impact Treg regulation, enhancing their abundance, reinforcing their stability, and amplifying their repressive functions. Furthermore, they facilitate an overall transition towards an anti-inflammatory milieu by downregulating pro-inflammatory elements and upregulating anti-inflammatory cytokines. Utilizing the EAE model, researchers have discovered that MSC-exosomes substantially improve neurological manifestations, minimize demyelination, and reduce axonal impairment through targeted actions on Treg growth and restraint of harmful Th17 cells.

Conclusion: Emerging research indicates that MSC-derived exosomes show considerable promise in addressing MS and related autoimmune diseases. Their unique capability to manipulate Treg activity enables restoration of immune equilibrium without triggering extensive immune suppression. While further exploration is essential to refine optimal dosages, scheduling, and long-term safety profiles, MSC-derived exosomes constitute an enticing area of interest for forthcoming cell-free regenerative medicines aiming at benefiting those afflicted by MS and comparable autoimmune conditions. Efforts are already underway to transform these exosomes into practical therapeutic alternatives for people grappling with these challenging health issues.

Keywords: Mesenchymal stem cells (MSCs), Exosomes, Regulatory T cells (Tregs), Multiple sclerosis (MS), Immunomodulation, Experimental autoimmune encephalomyelitis (EAE)

72.

Effects of Mesenchymal Stem Cell-Derived Exosomes in Multiple

Abdullah Yadegari[1], Shirin Barati[2], Hamid Reza Zeratie[1], Alireza Eliasi[1] , Amir Mohammad Hatami [1], Elmira Roshani Asl[3] *

1. Student Research Committee, Saveh University of Medical Sciences, Saveh, Iran

2. Department of Anatomy, Saveh University of Medical Sciences, Saveh, Iran.

3. Department of Biochemistry, Saveh University of Medical Sciences, Saveh, Iran

Abstract:

Background and objectives: Multiple sclerosis (MS) is a chronic inflammatory and demyelinating disease in young to middle-aged adults that affect~2.5 million people worldwide. most therapeutics for MS such as immunomodulatory drugs reverse the disease and have the potential to cause severe adverse events. MSC-derived exosomes could affect neuroinflammation possibly through specific immunomodulatory miRNAs acting on microglia.

Materials and methods: We searched PubMed, Google Scholar, Clinical Trials and other Databases. We also reviewed these articles and collected the necessary information.

Results: Mesenchymal stem cells (MSCs) are nonhematopoietic multipotent with strong self-renewal ability and multipotent **p**roperti**es** to differentiate into different lineages and postulated to be a novel therapeutic strategy for self-cell repair. Four main properties of MSCs have immunomodulation, neuroregeneration and differentiation, migration capacity excretion of soluble factors. MSC-derived exosomes hold great potential to treat neurodegeneration-associated neurological diseases, MSCs-derived exosomes can cross the blood–brain barrier and deliver their cargo such as protein, miRNAs, lipid, and mRNA to injured brain tissue. Many studies indicated that MSCs-derived exosome therapy to induce neuronal axon protection, regeneration of damaged areas and also increase functional recovery.

Conclusion: Neurological impairments are usually irreversible due to regeneration in the central nervous system (CNS) and the treatment of autoimmune diseases is challenging and there is currently no effective cure. The transplantation of SCs into the brain causes numerous therapeutic mechanisms. These promising results encourage the use of MSCs-derived exosomes in for the treatment of autoimmune diseases such as MS.

Keywords: Multiple sclerosis, Mesenchymal stem cells, MSCs-derived exosomes

73.

Diabetic Foot Ulcer and Stem Cell-Based Therapy

Abdullah Yadegari[1], Shirin Barati [۲] , Arashk Moslehi [1] , Mahdi Gaffari [1] , AmirMahdi Safarian [1] , Elmira Roshani Asl [3]*

1. Student Research Committee, Saveh University of Medical Sciences, Saveh, Iran

2. Department of Anatomy, Saveh University of Medical Sciences, Saveh, Iran.

3. Department of Biochemistry, Saveh University of Medical Sciences, Saveh, Iran

Abstract:

Background and objectives: a major source of preventable morbidity in diabetic patients is Diabetic foot ulcers (DFU). Approximately 19-34% of diabetic patients will *develop a DFU in their lifetime*. The main cause of nontraumatic lower limb amputations is DFUs. Among *Several* preclinical models for the treatment of DFUs, the most effective one is therapy with gel dressings loaded with Stem cells (SCs).

Materials and methods: We searched PubMed, Google Scholar, Clinical Trials and other Databases. We also reviewed these articles and collected the necessary information.

Results: The main aspects of DFUs formation are peripheral neuropathy, peripheral artery disease, poor collagen synthesis and chronic inflammation. SCs express many cytokines and nerve growth factors that accelerate DFU healing by inducing with cell proliferation, angiogenesis, nerve growth and inflammatory response regulation. SCs with exclusive ability for differentiation plays an important role in wound healing. In recent years bone marrow mesenchymal SCs(MSCs) are the most commonly used type for the treatment of skin wounds. MSCs leading to tissue repair by moderate the production of effector T-cell cytokines and macrophages polarization toward the M2 phenotype. Also Many studies have indicated that umbilical cord mesenchymal SCs (UCMSCs) have similar characteristics such as fibroblast morphology, immunophenotype markers, multiple differentiation potential and low immunogenicity.

Conclusion: The potential mechanism of DFU formation is complex and unclear. Some clinical treatments are ineffective in *DFU patients.* SC therapy a new option for tissue repair and regeneration because this treatments improves migration, survival of fibroblasts and enhancing the healing effects by producing a variety of growth factors.

Keywords: Diabetic foot ulcers, Stem cells, mesenchymal SCs, umbilical cord mesenchymal SCs

74.

Fabrication and evaluation of antibacterial fabrics using sonochemical method for wound healing applications

Safa Momeni Badeleh[1], Morteza Abazari[2]

1. Department of Food and Drug Control, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran.

2. Department of Pharmaceutical Nanotechnology, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran.

Abstract:

Aim and Background

The expansion of new packaging products due to increased consumer demand for microbiologically healthier foods, smaller packages, and longer shelf life has recently been the focus of academic and industrial sectors. In this regard, decorating packaging substrates with metallic or non-metallic nanomaterials has been reported as an effective strategy for designing and developing smart and advanced packaging. Therefore, in the present study, we used the sonochemical method for in situ production and simultaneous deposition of silver nanoparticles on non-woven Chafer fabric surfaces to create novel antibacterial packaging.

Methods

The sonochemical method in aqueous media containing silver precursor ($AgNO_3$), complexing compound (NH_3), and reducing agent ($C_2H_6O_2$) is used to deposit silver nanoparticles on non-woven substrates at different sonication times and precursor concentrations. The resultant fabrics are fully characterized and evaluated for their physicochemical and functional properties in terms of structural, mechanical, morphological, thermal, and antibacterial properties.

Results and discussion

The characterization of resultant fabrics indicated remarkably stable and uniform deposition of silver nanoparticles by varying the effective parameters that control the extent and quality of coatings. The antibacterial activity and cytotoxicity of resultant fabrics demonstrated highly efficient bactericidal activity (against *E. coli* and *S. aureus*) and desired biocompatibility (toward *HEK 293* cells and Artemia nauplii).

Conclusion

In summary, the resultant silver nanoparticles-containing fabrics in this study can be used as a cheap, non-toxic, and commonly available materials for food packaging and other possible applications such as wound dressing, bed lining, medicinal bandages, water and air purification, domestic cleaning, etc.

Keywords: Sonochemistry, Nanomaterials, Silver, Nanoparticles, Packaging.

75.

Review of Carboxymethyl cellulose and Gelatin as natural biomaterials in skin regeneration

Shaghayegh Doudi[1,2], Mohammad Eini[3], Majid Salehi[2,4*]

1. Student Research Committee, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

2. Department of Tissue Engineering, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran.

3. Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Science, Tehran, Iran.

4. Tissue Engineering and Stem Cells Research Center, Shahroud University of Medical Sciences, Shahroud, Iran

Abstract: Skin is one of the most important organs of the body, which serves as the main defense barrier, protecting against injuries, preventing infection and water loss. Due to the external position of this organ, the possibility of damage and dysfunction is high, which leads to body dehydration, infections, and possibly death in the affected person. for this reason, wound healing and skin regeneration are critical aspects of clinical management. Currently, there are common methods to control skin damage, including traditional dressing, autograft, allograft, and xenograft skin grafts. each of these methods has limitations, such as the requirement for bandage replacement, the need for re-surgery and being painful, the lack of donors, and the risk of disease transmission, respectively.

nowadays, tissue engineering and biomaterial science have provided the possibility of promoting the healing and regeneration of the skin with the least side effects by providing suitable wound dressings. Natural biomaterials are a favorable choice for skin tissue engineering due to their high biocompatibility, reasonable price, low toxicity, suitable biodegradability, and availability. Among the types of natural biomaterials, gelatin and carboxymethyl cellulose (CMC) are widely used in this field due to their outstanding properties. Gelatin is a type of denatured collagen, that is obtained from the controlled hydrolysis of collagen and breaking its natural triple helix structure; therefore, it has low antigenicity. It is the main component of skin and body tissues, and also a very hydrophilic natural protein that retains an important peptide and promotes signal transduction and cell adhesion. CMC is also allowed to be used as an additive in many foods due to its safe, hydrophilic, gelling, and film-forming properties. It has also been widely used in pharmaceutical (drug delivery, antimicrobial) and biomedical (wound dressing) applications. As a result, the use of hydrogel or films based on gelatin and CMC is a suitable option for the regeneration of damaged skin in clinical conditions.

Keywords: Skin, Regeneration, Gelatin, Carboxymethyl cellulose, Hydrogel

76.

Bone tissue regeneration aided by cerium oxide nanoparticles

Sina Farzi Molane[1]*

[1] *Department of Medical Nanotechnology, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran.*

Abstract: Fractures, congenital malformations, auto accidents, and osteoporosis are examples of bone deformities that are very expensive for patients and medical personnel. They rank among the largest issues facing human society. The most popular, but difficult, therapy option is bone transplantation. Even while bone has the ability to self-healing, there are situations where this ability is insufficient and other materials, like nanomaterials, are needed to speed up the healing process. Nanomaterials try to mimic the natural bone structure as much as possible and cause bone tissue regeneration, and one of the most common nanoparticles used in bone tissue engineering is cerium oxide nanoparticles.

Methods: We searched Google Scholar, PubMed databases, and Scopus and found 32 articles. 15 articles were selected with specific keywords.

Results: CeO_2-NPs are nanocrystals obtained from cerium. CeO_2-NPs have catalytic properties that change between Ce^{4+} and Ce^{+3}. Due to their special features such as antibacterial, anti-inflammatory, anti-cancer, non-toxic, angiogenic, drug/gene delivery, immune system modulator, antioxidant, theranostics and bioimaging properties, these nanoparticles play a fundamental role in tissue engineering and Regenerative medicine, especially for orthopedic treatments. Research has shown that CeO2-NPs not only possess intrinsic properties, but also enhance the properties and therapeutic efficacy of other materials when mixed with them in the field of bone tissue regeneration.

Conclusion: Presently, advances in the field of nanomedicine are crucial to bone tissue engineering and have the potential to open up new avenues for bone tissue regeneration treatment. Today, clinicians may cure bone problems more quickly and effectively by merging nanotechnology and medicine.

Keywords: CeO_2; Nanoparticle; Tissue regeneration; Tissue engineering; Bone regeneration

77.

Green synthesis of antioxidant-rich silver nanoparticles from *Rosmarinus officinalis*: antibacterial efficacy and hemocompatibility assessment

Habib Ghasempour[1], Muhamamd Hossien Armand[1], Mehdi sahranavard[1], Sara nikpour[1], Esmaeel Sharifi[2, *]

[1] *Department of Pharmacy, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran*

[2] *Department of Tissue Engineering, School of Advanced Technologies in Medicine, Hamadan University of Medical Sciences*

Abstract: In this study, the green synthesis method, utilizing *Rosmarinus officinalis* extract, is employed to produce silver nanoparticles (AgNPs). *Rosmarinus officinalis* from the *Lamiaceae* family has medicinal effects. Its leaves contain a high concentration of polyphenols, flavonoids and terpenoids. Due to their antioxidant and anti-inflammatory properties, polyphenol and flavonoid compounds can help in healing wounds. Green synthesis of metallic nanoparticles is eco-friendly approach, which offers a sustainable alternative to conventional chemical methods, highlighting the potential of natural resources in nanotechnology. In this study, the green synthesized AgNPs are characterized using several techniques, including UV-Vis spectroscopy, X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and dynamic light scattering (DLS), field emission scanning electron microscopy (FESEM) and energy-dispersive X-ray spectroscopy (EDS). Physicochemical characterization confirmed the successful synthesis of aforementioned nanoparticles. The maximum absorption peak of synthesized AgNPs using UV spectrometer was 443 nm and the average hydrodynamic diameter of nanoparticles in DLS was 53.02±1.31nm. The synthesized nanoparticles were hemocompatible, and shown good antioxidant properties by using DPPH method. Antioxidant properties, and hemocompatibility are critical factors for potential biomedical applications, such as wound healing and drug delivery systems. Overall, this study provides valuable insights into the green synthesis of antioxidant-rich AgNPs from *Rosmarinus officinalis* and their potential biomedical applications.

Keywords: Rosmarinus officinalis, Green synthesis, Nanosilver

78.

In Vivo Study: PCL/CQD with Moringa Extract Conduit for Enhancing Structural and Functional Recovery in Rat Sciatic Nerve Injury

Samira Shariati Najafabadi[1], Mohsen Shie Karizmeh[2], Hamid Bahramian[1], Hossein Salehi[1]*

1. Department of Anatomical Sciences, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

2. Department of Advanced Medical Technology, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract: Peripheral nerve injuries (PNI) present a challenging problem due to complications such as the loss of target tissue function and neuropathy following current treatments. While autologous nerve grafting is considered the 'gold standard' for nerve repair, it has its limitations. Therefore, given the increasing prevalence of PNI and the lack of a definitive cure, researchers are still exploring new treatment methods. One novel and effective approach involves using nerve conduits to facilitate the growth and proper orientation of developing axons. Natural or artificial polymers can be used for the synthesis of nerve conduits. PCL, as a synthetic polymer, has mechanical properties and degradability suitable for nerve tissue. Additionally, various materials can be employed to enhance conduit properties and contribute to further nerve regeneration. In this study, Carbon Quantum Dots (CQD) were utilized to improve the physical-chemical and electrical properties of the conduits, mimicking the extracellular matrix in nervous tissue. Moringa extract was also employed to induce neurogenesis and enhance nerve repair and growth. For this purpose, PCL and the electrospinning technique were used to fabricate three kinds of conduits: PCL, PCL/CQD, and PCL/CQD/Moringa. Then, the morphology, mechanical properties, water absorption, and degradation of the conduits were assessed. Subsequently, surgery was performed to create sciatic nerve injury, and conduit grafting was carried out. After three months, nerve and muscle reconstruction were evaluated using electrophysiological tests, real-time and immunohistochemistry techniques, histological staining, and Transmission Electron Microscopy (TEM). The results demonstrated that the PCL/CQD/Moringa conduit with aligned fibers possess appropriate biodegradability, water absorption, and mechanical properties for use in PNI. This conduit contributed to the structural and functional improvement of the injured sciatic nerve and the innervated muscle. Additionally, PCL/CQD conduit exhibited superior properties compared to PCL conduit, revealing more effective results in improving PNI. These findings suggest that PCL/CQD/Moringa conduit represent a promising strategy to enhance nerve regeneration, paving the way for therapeutic breakthroughs in PNI.

Keywords: Peripheral Nerve Injuries (PNI), Nerve Conduits, Carbon Quantum Dots (CQD), Moringa, Electrospinning, Sciatic Nerve Regeneration

79.

Exploring the Structural Dynamics of Two Scaffolds through Molecular Dynamics Simulation: A Comparative Study

Salva Golgoun[1], Hajar Mardi[2], Tabassom Beiranvand[1], Somaieh Soltani[1], Mohsen Padervand[2]

1. *Department of Medicinal Chemistry, pharmacy faculty, Tabriz University of Medical Science, Tabriz, Iran*

2. *Department of Chemistry, Faculty of sciences, University of Maragheh, Maragheh, Iran*

Abstract: Rising tissue injury rates and limited organs donators necessitate advanced therapeutic approaches. Collagen, as a natural ECM mimic, beside exclusive properties, lacks sufficient mechanical strength and functional properties. Researchers combine collagen with polymers like PVA and PCL to improve properties. Molecular dynamics simulations play a unique role in studying collagen-based composites, enabling designing and optimizing novel biomaterials. Unique interfacial behaviors of PVA and PCL blends with collagen open new doors for designing tailorable scaffolds. The main aim of this research is to address the possibility of using molecular dynamics (MD) simulation, as a computational framework for evaluating comparing two collagen-based scaffolds. In this study, the potential of polyvinyl alcohol (PVA) and polycaprolactone (PCL) polymers as alternative materials for enhancing collagen scaffold properties was explored. Through the utilization of classical molecular dynamics simulations based on fully atomistic models, an equilibrated molecular structure of polyvinyl alcohol (PVA) and poly caprolactone (PCL) in conjunction with collagen developed and subsequently compared two scaffolds collagen-PVA and collagen-PCL. Simulations were carried out by utilizing the Materials Studio 2017 software employing the COMPASS forcefield, in order to compare the scaffolds microstructural behavior at atomic scales, providing noteworthy insights into the interfacial interactions between collagen and synthetic polymers by calculating key parameters like enthalpy, density and mixing energy. The results indicate variations in structural conformation, intermolecular interactions, and density between collagen-PVA and collagen-PCL composites. The incorporation of PCL led to significant alteration in collagen compared to PVA. The identified variances in the mentioned scaffolds suggest that the interfacial behaviors are distinctive and influenced by the interactions of PVA and PCL with collagen. The obtained results provide opportunities for designing tailored scaffolds with enhanced properties. In conclusion, PCL demonstrates a promising potential for enhancing the properties of collagen-based scaffolds. The results of this study make a valuable contribution to the ongoing endeavors aimed at optimizing scaffolds and underscoring the potential of molecular dynamics simulations as a potent tool for advancing biomaterial research.

Keywords: Collagen, Scaffold, Molecular dynamics simulation

80.

Mesenchymal stem cells: promising treatment for liver cirrhosis ;A review

1st Zahra Ghafari, 2nd Zahra Hooshmand, 3rd Niyaz Gharooni, 4th Ahmadreza Aminian*

1,2,3. Student Research Committee, Arak University of Medical Sciences, Arak, Iran

4. Department of Physiology, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract: one of the considerable widespread chronic liver diseases is Liver cirrhosis. Liver cirrhosis definition is the belated step of liver fibrosis caused by numerous types of liver diseases and circumstances, containing hepatitis and prolonged alcoholism. Apoptotic bodies of hepatocytes are engulfed by Kupffer cells. Stimulated Kupffer cells then raise inflammatory response of hepatic stellate cells. Triggered hepatic stellate cells further increase inflammatory answer owing to their contractile, chemotactic, and proliferative properties. Stem cells, mostly mesenchymal stem cells (MSCs), change the hepatocyte purpose with relocation and differentiation. We observed PubMed, Google Scholar and other Databases. We also reviewed these articles and collected the necessary information. Recent researches of stem cell treatment for hepatic cirrhosis demonstrate stem cell transplantation might be a potential alternative to liver transplantation. MSCs have anti-inflammatory effects that reduce the stimulation of hepatic stellate cells by altering the macrophages' polarization towards an anti-inflammatory phenotype (interleukin (IL)-1 and IL-4.) MSC transplantation pointedly decreases the level of pro-inflammatory factors including tumor necrosis factor-α, IL-1β, IL-6, transforming growth factor-β1(TGF-β1) and enhances anti-oxidation and anti-apoptosis capability of hepatocytes. MSCs can be gained from perinatal tissue containing menstrual blood, adipose tissue, umbilical cord and common bone marrow. MSCs have the same features (negative for CD14, CD11b or CD34 and positive for CD90, CD105, or CD73.) Umbilical cord MSCs transplantation averts the activating of liverwort stellate cells through positive regulating microRNA-455-3p to intercede p21-activated kinase-2 stillness. Microencapsulated bone morrow MSCs implanted in injured tissue have a defensive result. (In fact, anti-inflammatory IL-1 receptor antagonist cytokines and anti-apoptotic IL-6 were liberated.). Adipose- originated MSCs therapy made decrease in the proportion of CD8+/CD4+ and the amount of inflammation-infiltrated CD11b+ cells in steatohepatitis-induced cirrhosis. Menstrual blood-derived MSCs noticeably lessened demonstration of alpha smooth muscle actin and TGF-β1 in tissue of liver and inhibited motivated liverwort stellate cells. Some of the confronted snags are the bounded homing and differentiation potential of stem cells and the risk for tumorigenesis in particular kinds of stem cells. Moreover, the most successful way of administering MSCs is not yet discovered. Their use in clinical trials has not been standardized until now.

Keywords: Liver cirrhosis, Hepatic stellate cells, Mesenchymal stem cells (MSCs)

81.

Stem cell therapy: with a focus on mitochondrial function

Rezvan Asgari [1], Kamran Mansouri [1]

[1] Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Today, stem cell therapy is important as an efficient approach in the therapeutic processes. In these treatments, stem cells uses as therapeutic agents. Stem cells are special cells in the body that have unique features like self-renew and differentiation into various types of cells. Moreover, the factors secreted by stem cells are involved in cell survival, proliferation, modulation of immunity and inflammation, and repair of damaged tissues. On the other hand, stem cells depend on mitochondria for their function. Mitochondria are dynamic organelles in the cells that play a significant role in control of the life and death of cells. In the cells, mitochondria are the major source of adenosine triphosphate. In addition, mitochondria are involved in the regulation of the behavior of stem cells. They can effect on the function of stem cells like differentiation, apoptosis, ageing, proliferation, and immune regulation. During self-renewal and differentiation of stem cells, mitochondria undergo special dynamics. The change of mitochondrial dynamics, fine-tuned via signaling and stem cell niche factors, has considerable effects on the behavior of stem cells. During stem cell differentiation also mitochondrial biogenesis is enhanced, resulting in an enhancement of mitochondrial number in the differentiated cells. Moreover, stem cells are involved in mitochondrial transfer, a phenomenon that is related to physiological and pathological processes. Stem cell-based therapies can effectually use mitochondrial transfer in order to restore physiological functions and recover pathological conditions. The transfer of mitochondria can restore the bioenergetic needs of cells and be considered as a significant method for repairing and regenerating and repairing damaged cells or tissues. Therefore, due to the association between mitochondrion and stem cells, targeting this organelle in stem cell-based therapies can contribute to effective results in the therapeutic processes.

Keywords: Stem cell, Mitochondrion, Treatment, Stem cell therapy

82.

Stem cell-derived exosomes: a beneficial cell-free *therapeutic* option in regenerative medicine

Rezvan Asgari [1], Kamran Mansouri [1]

[1] Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: Regenerative medicine is a field of medicine, which its purpose is regrow, repair or replace damaged or defective cells or tissues. This science contains stem cell therapy, biomaterials and tissue engineering. In stem cell therapy, stem cells are used as therapeutic agents. Stem cells are a special type of body cells, which have the unique abilities and can used in the treatment of various disorders and diseases. Despite the beneficial properties of stem cells there remain limitations and challenges. Stem cell implantation faces considerable challenges like immune response, differentiation control, and tumorigenicity. Therefore, cell-free therapies such as factors secreted by stem cells including exosomes can avoid these issues. Exosomes are soluble and extracellular vesicles in the size of 30 -150 nm that can generated under physiological or pathological conditions. These vesicles contain various factors such as lipids, proteins, RNAs, and miRNAs. Exosomes have the functions similar to those of stem cells. Exosomes play important roles in cell proliferation, survival, angiogenesis, modulation of immunity and inflammation, repair of damaged tissues, intercellular communications, apoptosis, and gene expression. Exosomes have also features like low immunogenicity, good biomembrane penetration capacity, innate stability, biocompatibility. Moreover, it has been theorizes that exosomes are more effective, safer, less time and materials for preparation, and less cumbersome compared to stem cells for therapeutic purposes. Also, the paracrine signaling in the form of exosomes can have the similar uses to stem cells while avoiding complications from transplant of stem cell that is a graft-versus-host concern. In conclusion, it seems that exosomes-based cell-free therapy can be an effective and promising approach in therapeutic processes for avoiding the challenges of using stem cells.

Keywords: Regenerative medicine, Stem cell, Exosome, Cell-free therapy

83.

Multifunctional Bilayer Dressing with Gelatin Methacrylate for Wound Healing

1st Radmehr Kazemi[1], 2nd Asghar Eskandarinia[2], 3rd Younes Ghasemi[1,2]

1. Pharmaceutical Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

2. Department of Pharmaceutical Biotechnology, Faculty of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran

Abstract:

Introduction:

The exploration of multifunctional bilayer wound dressings for various medical interventions in wound healing has garnered significant attention over the decades. Despite extensive research, synthesizing a single hydrogel with all necessary capabilities remains challenging. This paper proposes a bilayer model with an outer layer specifically designed for hydrogel wound treatment. By incorporating gelatin methacrylate (GelMA) into the hydrogel composition and utilizing a polyvinyl alcohol-chitosan foam layer as support, a photocrosslinkable hydrogel with an optimal formulation was developed. The study aims to investigate the properties and efficacy of this bilayer wound dressing through a range of analytical procedures.

Methods: The hydrogels underwent thorough examination using mechanical testing, rheology, chemical characterization, and both in vitro and in vivo tests. These analyses aimed to assess crucial properties such as uniform adhesion and the ability to undergo rapid crosslinking when exposed to UV light. Additionally, the antibacterial efficacy of the bilayer wound dressings against Gram-positive and Gram-negative bacterial strains was evaluated. The impact of GelMA on wound healing was also investigated by comparing the outcomes of bilayer dressings with and without this element.

Results: The resulting bilayer wound dressing demonstrated several desirable properties, including uniform adhesion and quick crosslinking under UV light exposure. Bilayer dressings exhibited broad antibacterial efficacy against both Gram-positive and Gram-negative bacterial strains. Furthermore, bilayer wound dressings containing GelMA showed improved wound healing compared to those without this component, suggesting its significance in promoting wound recovery. Moreover, the encouragement of collagen production and reduction in wound infection highlighted the major therapeutic impact of these dressings on wounds.

Conclusion: This study underscores the development of an effective bilayer wound dressing with promising properties for wound management. By incorporating GelMA and utilizing a polyvinyl alcohol-chitosan foam layer, enhanced antibacterial efficacy and improved wound healing were achieved. These findings carry significant implications for the advancement of wound dressing technology, indicating potential pathways for the development of more efficacious wound care solutions in the future.

Keywords: Gelatin, Methacrylate, Wound Healing

84.

Therapeutic potential of alginate-based hydrogels containing cross-linked chitosan with cyclophosphazene derivative as antibacrerial wound dressing: synthesis, biological assessment and computational study

Hossein Derakhshankhah[1,*], Mahnaz Mohammadpour[2], Hadi Samadian[3]

[1] *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[2] *Department of Chemistry, Faculty of Sciences, Tarbiat Modares University, Tehran, Iran*

[3] *Research Center for Molecular Medicine, Hamadan University of Medical Sciences, Hamadan, Iran*

Abstract: Since the favorable effect of chitosan and alginate biopolymers on skin lesions has been reported in published research, we investigated the capability of a series of composite hydrogels consisting of sodium alginate (ALG) and cross-linked chitosan (Ch) as a wound dressing. The dressing of hydrogels consisted of an ALG matrix containing Ch cross-linked with formyl-cyclotriphosphazene (Ch-PN) and its Zn complex (Ch-PN-Zn). The cross-linking of Ch was performed by the Schiff base reaction between Ch amine groups and cyclotriphosphazene aldehyde groups. After mixing the Ch-PN and Ch-PN-Zn powder with ALG and ionic crosslinking of ALG with Ca^{2+}, the final dressing hydrogel was prepared. Technics of FTIR, XRD and TGA/DSC were used to explore the expected connections and functional groups. Computational calculations of compounds structure with the Material Studio 2017 program based on DFT-D by $Dmol^3$ module, while providing the optimal structure of the compounds, showed ALG molecules are well adsorbed on the surface of Ch-PN and Ch-PN-Zn with appropriate binding energy. By mixing different concentrations of Ch-PN and Ch-PN-Zn in different ratios with ALG, we prepared six hydrogels and their protein absorption, swelling behavior, degradation rate, hemocompatibility and cytotoxicity were compared with each other and with ALG/Ch. The internal structure of the hydrogel 3D networks was checked by SEM. To calculate the drug release rate, erythromycin was loaded into the hydrogels as a model drug. The obtained data were expressing the reduce of release rate of drug with the increase in the dose of Ch-PN and Ch-PN-Zn. The possible reason for this result is enhance the interaction between drug and the particles. In this way, we introduced hydrogels with optimal and adjustable with features. MTT reagent was employed to assess the cytocompatibility of the ALG-based dressings with/without metal ion that all presented an effective biocompability. The antibacterial activity of composites versus E-coil and S. aureus bacteria was assessed and an outstanding antibacterial ability was funded for hydrogel possessing metal. Consequently, fabricated hydrogels can be proper candidates for wound dressing owing to creating a humid, breathable and antibacterial microenvironment favorable for cell adhesion, proliferation and migration, and their excellent capacity to wound secretions removal.

Keywords: Sodium alginate, Chitosan, Wound dressing, Schiff base reaction.

85.

Synthesis, characterization, biological properties, and computer simulation studies of nanofibrous containing gentamycin-conjugated nanoclay as wound dressing

Hossein Derakhshankhah[1,*], Hadi Samadian[2,*], Mahnaz Mohammadpour[3,*]

[1] *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[2] *Research Center for Molecular Medicine, Hamadan University of Medical Sciences, Hamadan, Iran*

[3] *Department of Chemistry, Faculty of Sciences, Tarbiat Modares University, Tehran, Iran*

Abstract: The aim of this work is to introduce the formula of polyvinyl alcohol/kaolin/gentamicin (PVA/Kao/Gen), in which Kao/Gen is distributed in PVA at concentrations of 5, 10 and 15 %w/w. The results of computer calculations, due to the proper orientation of N and O groups in Gen and Kao, confirmed the possibility of their effective interaction and drug penetration in kaolin. The data obtained from DLS and zeta potential analysis showed the change in the size and charge of Kao particles after combining with Gen, indicating the penetration of the drug into the Kao layers. Based on the images obtained from SEM, as the concentration increases of Kao/Gen to the polymer, the diameter of the nanofibers enhanced, and beaded nanofibers were created. Actually, incorporation of kaolin augments the viscosity of the solution and the viscoelastic force in the electrospun process, hence the diameter of the fibers increases. Data analysis of FTIR of PVA/Kao/Gen nanofibers showed the peaks related to functional groups of compounds without chemical shift, which indicates their physical composition. The XRD spectrum of the prepared structures shows a crystal pattern for it. Measuring the contact angle of nanofibers displayed the improve of their hydrophilicity with the increase of Kao/Gen concentration, which leads to the increment of water absorption into their structure. The presence of Kao/Gen nanoparticles in nanofibers reduces their mechanical tensile strength, and development their strain and elongation. This increases the flexibility of nanofibers and makes them easier to use as wound dressings. Investigation of the drug release rate exhibits the release from nanofibers containing 10% of Kao/Gen seems more reasonable than other nanofibers. Blood and fibroblast cell compatibility studies confirmed the biocompatibility and non-toxicity of all nanofibers for cells in vitro. Finally, the excellent antibacterial activity of the created structures, while the non-loaded Kao/Gen nanofibers did not show any antibacterial activity, is considered a very important and practical feature in the preparation of wound dressing. Generally, the nanofibers containing gentamicin reinforces its healing effect compared to the normal product, therefore, it can be used as a wound dressing with an easy preparation method and enhanced therapeutic effect in wound care.

Keywords: Nanofiber wound dressing, Gentamycin, Polyvinyl alcohol (PVA), Kaolin, Nanoclay, Gossin.

86.

“Application of decellularized pericardium in tissue engineering”

Parand Shariat Rad, Leila Rezakhani

1. *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran - USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

2. *Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran- Department of Tissue Engineering, School of Medical ne, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Disease involvement over time makes us be aware that current therapies may not be efficient in the near future and we need new methods to overcome these diseases. Tissue engineering, with its great potential to develop tissues and even organs from synthetic and biological material, opens a new gateway toward definitive treatments. Also, in regenerative medicine, as a subtype of Tissue engineering, decellularized tissues represent a promising approach to address the limitations of previous methods. All we aim to achieve in tissue engineering is to assemble functional constructs that restore, maintain, or improve damaged tissues or whole organs, and “decellularized pericardium” can provide all of these benefits.

The special mechanical properties and immunocompatibility of decellularized tissues are important features that give the decellularized medicine a superiority over synthetic tissue engineering models. Based on the tissue used for decellularization these features can vary. Pericardium, a double-layered membrane around the heart of mammalians, serves as a natural extracellular matrix that has been utilized in cardiac surgery for many years. However, the use of decellularized pericardium as a scaffold for tissue engineering has gained significant attention in recent times, due to its special retention strength, flexibility, supports for cell growth and differentiation, among other qualities. that altogether put it among the top choices for tissue engineering and regenerative medicine. These all indicate that we are paving the way for a new era of personalized medicine and transformative healthcare interventions.

In this review we aim to cover the different decellularization methods, application of decellularized pericardium, available commercial products, as well as challenges and future direction of this promising therapy.

Keywords: Tissue engineering, Decellularized tissue, Regenerative medicine, Decellularized pericardium

87.

Bridging Gaps in Chronic Wound Healing by a Chitosan-based Advanced Wound Dressing

Parnaz Mohseni[1], Ghazal Shariat Panahi[1], Amir Ghasemi[1], Majid Deilami[1], Mohammad Raoufi[1*]

1. Nano Narin Teb Co., Tehran, Iran. P.O. Box 1917753531

Abstract:

Background:

Tissue engineering and regenerative medicine play crucial roles in advancing wound healing, particularly in chronic wounds. Biopolymer-based dressings offer promising solutions by providing a supportive framework for cell growth and tissue regeneration. In this study, we employ tissue engineering to construct functional frameworks that enhance the restoration or enhancement of impaired wound healing.

Methods:

Our research has led to the development of a multifunctional wound dressing scaffold that intricates the process of wound healing. In this study, we assess the clinical impact of this composite dressing on 30 patients experiencing wounds of diverse etiologies during 8 weeks of treatment.

Results:

The study demonstrated a noteworthy reduction in wound area ($p < 0.05$), decreasing from 58.84 cm^2 at week zero to 10.66 cm^2 by the study's conclusion. Moreover, there was a significant increase ($p < 0.05$) in the proportion of epithelialized tissue, progressing from 17.2% initially to 65.11% after 8 weeks. Notable reductions were observed in necrotic and slough tissue, declining from 3.33% and 26.5% at week zero to 0.83% and 6.03% at week 8, respectively. Initial hypergranulation tissue, covering 9% of wounds, was completely resolved by the study's end. Also, the composite dressing played a pivotal role in infection elimination ($p < 0.05$).

Conclusion:

In conclusion, our multifunctional composite dressing exhibited significant improvements in wound healing parameters, showcasing its potential as an effective therapeutic intervention for diverse wound etiologies.

Keywords: Wound care, Infection, antibacterial, biofilm, Exudate

88.

Bioactive glass Nanoparticles Loading into Bacterial Cellulose nanofiber for Bone Engineering Applications

Elham Ghanbari [1*], Behrooz Niknafs [2], Mohamed Ali Mesgarof [3]

1. *Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.*
2. *Immunology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.*
3. *Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

Abstract:

Background and Objectives: Nowadays many patients are suffering from large bone defects as a result of bone-related diseases and tumors or trauma. Bacterial cellulose (BC) possesses high porosity, water holding capacity, purity, biocompatibility, and mechanical strength. Considering advantageous properties of bioactive glass-loaded BC polymer composites, the objective of the present investigation synthesizes a modified Bioactive glass/BC biomimetic scaffold with improved properties.

Methods: In this experimental study, the leaf extract of Camellia sinensis was used to synthesize Bioactive glass. The synthesized scaffold and nanoparticles were characterized by fourier transform infrared spectroscopy (FTIR), energy dispersive x-ray analysis (EDX), and scanning electron microscopes (SEM). In addition, scaffold degradation rate, swelling, porosity, mechanical properties, cell attachment, cytotoxicity, and biocompatibility were measured. Moreover, the cytocompatibility of the Bioactive glass /BC scaffolds was evaluated by cell attachment studies using MG63 cells and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) analysis.

Results: Bioactive glass have a high absorption peak at 280 nm in their UV-visible spectra. DLS data revealed that the Bioactive glass have a single peak at 72 nm. The presence of magnesium and oxygen was confirmed by EDX analysis. FTIR analysis showed the presence of functional groups specific to Bioactive glass and scaffolds. Zeta potential value revealed that the bioactive glass was highly stable at -19mV. The physicochemical properties of BC/ Bioactive glass indicated good porosity and interconnectivity for cell penetration and colonization. Additionally, adding Bioactive glass to the scaffold improves its compressive strength.

Conclusion: The addition of green synthetic Bioactive glass into the BC scaffold improves osteogenic properties and these scaffolds can provide a 3D platform for bone regeneration.

Keywords: Bacterial cellulose; Magnesium; Nanoparticles; Bone tissue engineering; Nanocomposite.

89.

The role of scaffolds including metal filaments in the regeneration of damaged nerve tissue

1st Azadeh Nochalabadi, 2nd Leila Rezakhani

1. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: The nervous system, which is separated into the peripheral and central nervous systems, is one of the most intricate systems in the human body. The complicated and difficult biological process of CNS regeneration is hampered by neurons' limited ability to regenerate and by conditions that impede nerve damage from healing. Strategies for neural tissue regeneration and repair have drawn a lot of attention since they directly impact the patient's quality of life. The key to the success of neural tissue engineering lies in controlling the behavior of cells and the growth of tissues by creating a synthetic scaffold that can sustain three-dimensional cell cultures and is similar to the extracellular matrix found in nature. Due to axon discontinuity, degeneration, and eventual death, sciatic nerve injuries frequently result in partial or complete loss of motor, sensory, and autonomic capabilities. Ultimately leads to a significant reduction in functional ability and a lower quality of life. The shortcomings of the hollow scaffolds that are now on the market could be solved by including internal guidance support. Using absorbable metal filaments to provide physical support and guidance for nerve regeneration that eventually safely leaves the body is a revolutionary technique. Magnesium metal (Mg) thin filaments would promote nerve regeneration. zinc (Zn) Alloy shows a higher concentration of local breakdown products and inflammatory cells compared to magnesium. ; Thin capsules of both metals do not show any changes in tissue stimulation and do not cause any inflammation or toxicity in the adjacent nerve tissues. Zn-2%Fe is biocompatible and has a lot of promise for application in the regeneration and repair of neural tissue, just as Mg.

Keywords: Nerve Regeneration, Scaffold, Metal Filaments

90.

Chitosan-based hydrogel scaffolds in burn wound healing

Azadeh Nochalabadi[1], Leila Rezakhani[2]

1. Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Department of Tissue Engineering, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract:

Background: The most important human organ, the skin, is capable of repairing itself after injury, although a number of circumstances can prevent a lesion from healing. An estimated 6.5 million Americans are thought to be suffering with chronic, non-healing wounds, which to cost more than $25 billion annually. Many novel dressings and medication regimens have been created in the past 20 years to enhance natural wound healing. The ideal wound dressing should create a moist environment, guard against infection, and hasten the healing process the process of healing. They have a variety of mechanical qualities and are adaptable, increasing wetness and chilling the area of the wound to lessen discomfort. Using natural materials such as chitosan offers various advantages due to its hemostatic qualities, biocompatibility, and biodegradability; nevertheless, due to its restricted flexibility, it can readily shatter into smaller fragments. A number of dangers, including microbial infection, an increased inflammatory response, and the production of pathologic scar tissue, are linked to burn or combat injuries. These risks can seriously impede the healing process and delay wound recovery. Burn or combat injuries are associated with several risks, such as microbial infection, an augmented inflammatory response, and the formation of pathologic scar tissue. These dangers have the potential to significantly slow wound healing and postpone wound recovery. Chitosan scaffolds provide a moist environment for wounds that promotes epidermal growth and healing. Biomaterials based on chitosan show promise as a treatment for wounds. Different types of biomaterials such as hydrogel, film, scaffold, etc. dressings are reported. In the target tissue, natural biomaterials can control cell division and proliferation. Biomaterials are being extensively used in regenerative medicine including tissue engineering applications, as these enhance tissue development, repair, and help in the process of angiogenesis. Therefore, in addition to antibacterial medicines, significant biomaterials are needed for wound healing in both acute and chronic wounds. Among the biomaterials that have been examined, chitosan-based biomaterials and other carbohydrate polymers are well-known and frequently utilized for wound healing applications.

Keywords: Chitosan, Hydrogel scaffolds, Burn wound.

91.

A review on recent advancements in ovarian tissue engineering

Azadeh Jamshidi

1. Department of Biology, Faculty of Basic Sciences, Razi University, Kermanshah, Iran

Absreact: Commonly utilized therapies for improving and preserving fertility in women diagnosed with cancer, diseases and disorders of the female reproductive tissues including oocyte, embryo, ovarian tissue cryopreservation, assisted reproductive techniques like in vitro fertilization and hormone replacement therapy are not adequate and also are not suitable for all individuals.

Therefore, there is a essential need to discover methods that are effective for all population in different ages. Regenerative medicine with tissue engineering of the female reproductive tissues and organs presents new effective treatments. Produce and transplantation of ovary as a potential solution can be a suitable option in the treatment of female infertility and ovarian dysfunction. It can overcome the limitation of traditional strategies. The ovarian tissue engineering include a combination of cells, biomaterials, various growth factors and biologically active molecules that can repair organ and provides a 3D system for folliculogenesis and follicle growth. The engineered tissue can be implanted into the target place to repair or replace the impaired tissue. Hydrogels and scaffolds are efficient biomaterials that can arrange cells such as stem cells and tissues and also organs under 3D conditions for regenerative medicine and tissue engineering applications. Two procedures in tissue engineering, scaffold-free like stem cell transplantation and scaffold-based like 3D printing can compose functional ovarian tissue.

The aim of the present review is to summarize the appropriate properties of numerous biomaterials in ovarian tissue engineering and discuss the recent advancements in bioengineering methods implemented to the ovarian tissue for improving ovarian function and fertility.

Keywords: Tissue engineering, Ovarian tissue, 3D system, Transplantation

92.

Top Marine-Derived Materials for Bone Regeneration: A Literature Review

1st Author: Arshia Javadizadeh[1], 2nd Author: Yasaman Naghibzadeh[1], 3rd Author: Leila Rezakhani[2]

[1] *Students Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran*

2. *Fertility and Infertility Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: Bone tissue is a complex and important component of the human body. Some bone-related damage can't be self-repaired and requires special treatments like graft methods. Allograft and xenograft are conventional techniques but using these methods faces challenges such as the potential risk of provoking an immune response against the transplanted tissue.; Therefore, the utilization of tissue engineering for bone regeneration appears imperative as it represents a safer and more compatible approach to treatment. Marine decellularized tissue has extraordinary features like biochemical mechanisms and pharmacological stability that make it ideal as a tissue engineering material. Three-dimensional (3D) printed calcium phosphate cement (CPC) scaffolds originating from cockle shell is a compatible resource for bone regeneration. The utilization of carbonated hydroxyapatite (CHA) and marine atelocollagen (MC) from a species called *Paralichthys olivaceus* can also serve as a foundation for the process of bone regeneration. A new hydrogel scaffold called pearl powder (PP) hybrid fish gelatin methacrylate (GelMa) was developed for bone regeneration. The composition of this scaffold was inspired by the bone tissue itself. Additionally, the scaffold was loaded with vascular endothelial growth factor (VEGF), which is known to promote blood vessel formation and enhance bone healing. This innovative approach holds great potential for improving bone regeneration therapies. The accurate control of the composition and structure of the hybrid scaffold to meet clinical requirements can be achieved through the utilization of microfluidic-assisted 3D printing technology. Further research is required to explore additional studies aimed at identifying the optimal scaffold and tissue derived from marine species for bone regeneration.

Keywords: Materials, Marine, Bone Regeneration, Tissue Engineering

93.

Preparation of dissolving microneedle with the backing layer of electrospun nanofibers for wound healing acceleration

Maryam Toolabi[1], Mahsa Akbari[1], Zeinab Pourmansouri[2], Mohammad-Reza Eskandari[2] and Mohammad-Ali Shahbazi[3*]

1. *Zanjan Pharmaceutical Nanotechnology Research Center, Zanjan University of Medical Sciences, Zanjan, Iran*

2. *Department of Pharmacology and Toxicology, Faculty of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran*

3. *Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands*

Abstract:

Introduction: Wound healing is a complicated physiological process that requires an appropriate environment to encourage healing process. Herein, we develop a novel dissolving microneedle (MN) patch with electrospun nanofibers backing layer that can perform transdermal delivery and combination therapy for wound healing. Nanofibrous scaffold combined of poly (vinyl alcohol) and gelatin loaded with taurine and Bi_2S_3 nanoparticles was prepared by electrospinning method, called PGTBi. The needle of the MN, called PHA, was composed of poly methyl vinyl ether-alt-maleic acid, hyaluronic acid and allantoin.

Methods: The PGTBi-PHA MN patches were fabricated via a molding method in a two-step casting process. All characterization assays including size and photothermal performance of the Bi_2S_3 nanoparticles, morphology and mechanical properties of the fibers, and ex vivo and in vitro insertion of the needle in the skin and parafilm were performed to ensure the fabricated device meet desirable property for effective wound healing.

Results: TEM image, zeta potential and elemental analysis indicated successful synthesis of Bi_2S_3 NPs. The temperature of Bi_2S_3 NPs increased by about 50.4 °C at a concentration of 200 µg/mL after irradiation for 10 min, which is the temperature required to kill bacteria, indicating the excellent photothermal performance of Bi_2S_3 NPs. Investigation of tensile tests showed that Young's modulus of the nanofiber mats was 168.4 MPa, which was in the skin range. Parafilm and skin insertion tests show that the PGTBi-PHA MN patches have sufficient strength to penetrate the skin and successfully release their contents after dissolution.

Conclusion: In this study, an electrospun patch with photothermal property was successfully incorporated into the backing layer of MNs for wound healing application. This technology can combine different therapeutic modalities to enhance the overall healing process of wound on the skin.

Keywords: Nanofiber, Electrospinning, Skin Tissue Engineering, Microneedl

94.

The Importance of Oxygenation and Modification of Macrocapsules in the Normoglycemia and the Success of Transplantation in Diabetes (Original)

Nasrin Kakaei[a, b, c], Zhila Izadi[b*]

[a.] *Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran.*

[b] *Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[c] *USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Abstract: A novel treatment for type 1 diabetes has been introduced: pancreatic islet transplantation. Immune system attacks and the requirement for immunosuppressive drugs, however, restrict the efficacy of this approach. One interesting strategy is to encapsulate pancreatic islets. But with this method, pancreatic islet cells transplanted are not supplied with enough oxygen to support their optimal physiological function. Using oxygen-carrier compounds is one solution to overcome this obstacle. The macrocapsule core is oxygenated by perfluorooctylbromide (PFOB), which is abundant in an alginate hydrogel that encapsulates the pancreatic islets. The surface of the macrocapsules was modified because the polyethersulfone polymer utilized in the design of the macrocapsules is hydrophobic. Prior to transplanting the macrocapsules into the peritoneal cavity of streptozocin-induced diabetic rats, physicochemical and biocompatibility tests were conducted. The modified macrocapsule had an appropriate porosity to transfer the nutrients required by the encapsulated cells and to produce waste products and insulin, according to the obtained data. After modification, the contact angle measurement demonstrates that the macrocapsules' surface chemistry changed from hydrophobic to hydrophilic, which is a key factor for minimizing fibrosis and guaranteeing graft success. The evaluation of the transplanted macrocapsule showed highly encouraging results up to 5 weeks after transplantation, with fast blood glucose (FBG) levels in the normal range. Following device surface modification, Hematoxin/Eosin and Masson's trichrome staining proved the device's ability to promote angiogenesis and the absence of fibrotic tissue. The findings indicated that the PFOB-laden alginate hydrogel successfully encountered the challenge of oxygen limitation and resulted in an increase in oxygen available to the pancreatic islets throughout the capsule. In addition, it provided a safe and secure environment for the survival of the encapsulated islets.

Keywords: Macrocapsules, Perfluorooctylbromide (PFOB), Surface Modification, Pancreatic Islet, type 1 diabetes

95.

Microchip encapsulation and microRNA-7 overexpression of trabecular meshwork mesenchymal stem/stromal cells improve motor function after spinal cord injury

Parvin Mohammadi[1,6], Samad Nadri[2,3,4*], Alireza Abdanipour[5*], Yousef Mortazavi[6]

1. Regenerative Medicine Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. Department of Medical Nanotechnology, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran

3. Zanjan Metabolic Diseases Research Center, Zanjan University of Medical Sciences, Zanjan, Iran

4. Zanjan Pharmaceutical Nanotechnology Research Center, Zanjan University of Medical Sciences, Zanjan, Iran

5. Department of Anatomy, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran

6. Department of Medical Biotechnology, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran

Abstract: Manipulation of stem cells and microencapsulation through microfluidic chips has shown more promising results in treating complex conditions, such as spinal cord injury (SCI), than traditional treatments. This study aimed to investigate the potency of neural differentiation and its therapeutic role in SCI animal model of trabecular meshwork mesenchymal stem/stromal cells (TMMSCs) via miR-7 overexpression and microchip-encapsulated. TMMSCs are transduced with miR-7 via a lentiviral vector (TMMSCs-miR-7(+)) and encapsulated in alginate-reduced graphene oxide (alginate-rGO) hydrogel via a microfluidic chip. Neuronal differentiation of transduced cells in hydrogel (3D) and tissue cultures plate (2D) was assessed by expressing specific mRNAs and proteins. Further evaluation is being carried out through 3D and 2D TMMSCs-miR-7(+&-) transplantation into the rat contusion SCI model. TMMSCs-miR-7(+) encapsulated in the microfluidic chip (miR-7-3D) increased nestin, β-tubulin III, and MAP-2 expression compared with 2D culture. Moreover, miR-7-3D could improve locomotor behavior in contusion SCI rats, decrease cavity size, and increase myelination. Our results revealed that miR-7 and alginate-rGO hydrogel were involved in the neuronal differentiation of TMMSCs in a time-dependent manner. In addition, the microfluidic-encapsulated miR-7 overexpression TMMSCs represented a better survival and integration of the transplanted cells and the repair of SCI. Collectively, the combination of miR-7 overexpression and encapsulation of TMMSCs in hydrogels may represent a promising new treatment for SCI.

Keywords: Spinal cord injury, Contusion, Trabecular Meshwork Mesenchymal Stem/stromal Cells (TMMSCs), miR-7, Microfluidic chip, Differentiation, Hydrogel

96.

Injectable Photothermally Activate Antibacterial Hydrogel Incorporated with CuO Nanosheets for Sequential Melanoma Therapy and Accelerated Wound Healing

Vahideh Nosrati-Siahmazgi [1], Samin Abbaszadeh [2], Kiyan Musaie [1], Mohammad-Reza Eskandari [3], Hélder A. Santos [4], Mohammad-Ali Shahbazi [4*]

[1] Department of Pharmaceutical Biomaterials, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran
[2] Department of Pharmacology, School of medicine, Zanjan University of Medical Sciences, Zanjan, Iran
[3] Department of Pharmacology and Toxicology, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran
*[4 *] Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Groningen, Netherland*

Abstract:

Aim and Background: The conventional treatment process of melanoma includes surgical excision followed by chemotherapy and radiotherapy (1). However, the multidrug-resistant bacteria infected-wound and side effects of chemotherapy and radiotherapy are still important challenges. In recent years, photothermal therapy has made significant breakthroughs as a promising strategy to ablate cancer cells and bacteria (2, 3). Copper oxide (CuO) as a photoactive agent can show combined antimicrobial and photothermal effects for regenerative applications. Incorporating these nanoparticles along with allantoin inside the multifunctional hydrogel would allow the design of advanced formulation for melanoma therapy and tissue repair (4).

Methods: CuO nanosheets were synthesized by precipitation method. PG hydrogel was prepared through the chemical crosslinking between poly (methyl vinyl ether maleic acid) and gelatin, followed by the incorporation of CuO and allantoin to form PGCA hydrogel. Physicochemical characterization, injectable property, and photothermal performance of the hydrogel was assessed. Furthermore, antibacterial activity, wound healing assessment, and photothermal anti-cancer therapy of the hydrogel were evaluated.

Results and discussion: The successfully synthesized CuO nanosheets revealed good photothermal activity and efficiently removed melanoma cells. Moreover, by exploiting the intrinsic properties of CuO and allantoin, the hydrogel supported angiogenesis and proliferation of cells, respectively, which resulted in wound healing acceleration after cancer ablation. In addition, the abscess model results demonstrated that CuO effectively killed bacteria owing to the synergistic effect of hyperthermia and inherent antibacterial properties.

Conclusion: The multifunctional hydrogel was prepared to simultaneously ablate melanoma cells and bacteria. Moreover, the hydrogel effectively promoted wound healing via stimulating fibroblast proliferation and enhancing angiogenesis.

Keywords*:* Injectable hydrogel, Photothermal therapy, Melanoma therapy, Wound healing

97.

A Biomimetic Wood-based, Porous and Biodegradable Scaffold with Antibacterial Properties for Bone Regeneration

Saman Rezaei[1], Samin Abbaszadeh[2], Mohammad-Ali Shahbazi [3]

1. *Department of Pharmaceutical Biomaterials, School of Pharmacy, Zanjan University of Medical Science, Zanjan, Iran*

2. *Department of Pharmacology, School of Pharmacy, Urmia University of Medical Science, Urmia*

3. *Department of Biomedical Engineering, University Medical Center Groningen, University of Groningen, Netherlands*

Abstract:

Introduction: Bone-related diseases are common clinical problems that result in hardly recoverable bone defects. In this study, mild heat-induced osteogenesis is studied by a biodegradable wood-based scaffold coated with Bismuth Sulfide nanoparticles (NPs) while its pores are filled with gelatin-hyaluronic acid thermo-responsive hydrogel.

Material and methods: Initially natural wooden cubes were cured by chemical delignification. Bismuth Sulfide NPs were prepared using a simple chemical reaction and delignified wooden scaffolds (DW-scaffold) were coated with NPs entirely to generate Bi-scaffold. Then the scaffolds were immersed in gelatin-HA hydrogel for 4 hours (Bi-Gel scaffold). Following that, the scaffolds were dried by freeze-drying.

Results: The FE-SEM images of scaffolds demonstrated that the DW-scaffold coated with NPs and impregnated with gel while indicating desirable porosity. The elemental analysis of Bi-scaffold confirms that the scaffold coated with bismuth sulfide sufficiently. The compressive strength of Bi-Gel scaffold is approximately about 17.2 Mpa. The photothermal performance of the Bi-scaffold showed that the temperature increased rapidly to 76°C after NIR laser irradiation at 1.5 W/cm2, which confirms the high photothermal conversion efficiency of the scaffold. The scaffolds showed a very potent antibacterial effect against E. coli and S. aureus under NIR irradiation. Also, the initial results of in-vivo osteogenesis demonstrate the potential of scaffolds in large bone defect applications.

Discussion and conclusion: The Bi2S3 coated wooden scaffold has great potential in orthopedic applications due to good NIR-mediated and hydrogel-assisted osteogenic performances and this study provides new insights into the design and fabrication of new-style osteoimplants for bone regeneration.

Keywords: Tissue Engineering, Wood-Derived Scaffold, Hydrogel, Photothermal Therapy, Bone regeneration

- Lab/body/organ on a Chip

98.

Lab under the skin: Can Microneedles Pave the Way for a Paradigm Shift in Diagnosis and Treatment?

Maryamosadat Mavaei [1], Zhila Izadi [2,3]*, Alireza Lotfabadi [2]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran
2. Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran
3. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: With the development of microneedles (MNs) as a modern technology, the area of medical diagnosis and treatment could undergo an essential change. These minor, needle-like devices have the potential to develop healthcare programs since they can penetrate the skin at a microscopic level. The potential of MNs to transform conventional diagnostic methods has attracted a lot of attention. These MNs can sample interstitial blood, fluid and even track biomarkers in real-time by painlessly penetrating the skin's surface. This non-invasive system of diagnostic testing has the potential to provide valid and quick results while also reduce patient pain and enhancing overall health outcomes. Additionally, microneedles present a cutting-edge approach to treatment and targeted medication administration. It is possible to directly distribute drugs and treatments to particular regions of interest, such as localized tumors or areas impacted by chronic illnesses, by avoiding the skin's protective layer. With the least amount of systemic side effects, this exact drug delivery method may improve therapy efficacy. However, there are a number of concerns and challenges associated to the usage of MNs in diagnosis and treatment. Guaranteeing the reliability and security of MN-based devices is critical. During the design and production stages, concerns including MNs breakage, sterilization, and infection risk need to be carefully taken into account. The creation of low-cost, readily integrated solutions into the existing healthcare infrastructure is essential to the effective use of MN systems. Overcoming legislative obstacles, ensuring that healthcare personnel have the proper training, and addressing public opinion and acceptability are other issues that need to be resolved. Despite these challenges, it is impossible to ignore the potential benefits of MNs in diagnosis and treatment. The conception of a "Lab under the skin" could revolutionize medical approach by present real-time, individualized data for precise diagnosis and focused treatments. In conclusion, MNs could lead to a paradigm change in the identification and management of therapeutic conditions. Their capacity to supply a "Lab under the skin" situation generate new possibilities for focused therapies, non-invasive diagnostics and personalized medicine.

Keywords: Lab under the skin, Microneedles, Diagnosis, Treatment

99.

Investigation of electrophysiological features of neurons in Blood spinal cord barrier Organ-on-a-chips co-culture systems

1st Mohammadmehdi Monazah[1,2], 2nd sepideh geravand[1]

1. Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

2. USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: In the past human assumed that injuries to the central nervous system (CNS) are irreversible. However, in recent years, interesting studies have shown that nervous system regeneration is possible. Organ-on-a-chip technology as a human 3D CNS model and multidisciplinary approach can mimic the natural tissue. Those originating from the patient tissue are the most cost-effective manner to mimic human pathologies and, will help develop novel cell transplantation procedures that target the regeneration of missing or damaged cells in injuries.

This **review** research attempts to analyze the literature aiming to identify the strategies culture nervous system in a dish in various conditions.

Based on the current research findings, achieving Neural Progenitor Cells to generate 3D cultured Neurospheres, Organoids or Assembloids is possible from extra nervous system stem cells. On the other hand, Spinal cord injury simulation in mice and regeneration of structure in several studies evaluated and cell transplantation for this pathology have been proved. The coculture of different CNS cells is a challenge for researchers. Blood spinal cord barrier Organ-on-a-chips co-culture systems, especially focusing on spinal motor neurons, have the most in vitro similarity to physiological features of human spinal cord conditions, which can be used for making the pathologic environmental conditions for investigation of effects of different treatments like exosomes, growth factors. Besides, applying electrophysiological approaches to spinal motor neurons in this condition can be an interesting subject.

Our study investigated the ways of designing nervous system injury models with the help of previous studies to regenerate them and electrophysiological procedures under certain conditions aiming to repair spinal cord injuries.

Keywords: Organ-on-a-chip, Electrophysiology, Spinal cord injury.

100.

Non-invasive diabetes MOF-based biosensors

Anese Khalatbari Jafari, Maryam Karimi

1. Department of Inorganic Chemistry, Faculty of Chemistry, Isfahan University, Isfahan, Iran.
2. Department of Pharmaceutics and Pharmaceutical Nanotechnology, School of Pharmacy, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Abstract: Over 420 million people worldwide are affected by diabetes which is recognized by its developed chronic wounds and serious damage to the human body. Constant deviations from the normal range of blood glucose levels result in strokes, renal failure, heart attack, etc. The above-mentioned facts and the annual mortality rate of diabetes (1.5 million people) indicate that more effective measures for applying new diagnostic techniques and treatment methods should be taken.
Considerable potential for diabetes diagnosis, glucose detection, insulin delivery and wound healing are some applications of MOFs that have been reported over the past decade and made them promising candidates for diabetes therapeutic purposes. These tunable highly porous coordination polymers form several topological structures and offer notable features.
Special biological properties, the capability of post-synthetic modification, controlled degradation, targeted delivery, stable structure, biocompatibility, antibacterial activity and low toxicity are just a few of the features that have gained particular attention in biomedical science.

Primary MOF-based biosensors
Various strategies have been utilized for monitoring blood glucose levels by using MOFs as biosensors. Primary MOF-based detection mechanisms (chronoamperometry, voltammetry, differential pulse voltammetry) suffer from the shortcomings of invasive blood sampling and do not offer significant advantages in comparison with traditional and common diagnosis methods except for their speed and lower limit of detection.

A revolution in diabetes MOF-based diagnosis
While common blood sampling methods are invasive, some MOF-based biosensors have been developed that detect trace amounts of acetone and isopropanol as diabetes biomarkers with a simple and fast breath analysis. Although the mechanism is not completely clear, ZnO@ZIF-71 (CO) and ZnO@ZIF-71 (Ag) are two co-mixed metal MOFs with strong luminescence that their emission quenches in the presence of acetone and isopropanol, making them suitable candidates for fast non-invasive diabetes diagnosis.
As it has been demonstrated, MOFs play a valuable role in early diagnosis and in reducing the incidence and prevalence of this life-threatening metabolic disease.

Keywords: MOFs; Diagnosis of diabetes; Biosensor; Invasive sampling method; Blood glucose level

101.

Microfluidic technology for detection of cancer exosomes

1st Bahareh Valinezhad Saghezi, 2nd Kamran Mansouri

1. School of Pharmacy, Kermanshah University of Medical Sciences, Iran

2. Medical Biology Research Center, Kermanshah University of Medical Sciences, Kermanshah. Iran

Abstract: Cancer research has been at the forefront of research for several decades because of its high prevalence in the community and its incurable nature in advanced stages. Exosomes represent a complex population of extracellular vesicles actively released by tumor cells. Their key function is their ability to serve as potent signaling mediators, facilitating intercellular communication between cancer cells and their neighboring cells. Distinguished by their ubiquitous presence in a wide range of body fluids, exosomes are identified in the circulating blood during the early stages of cancer Exosomal markers expressed at the onset of tumorigenesis had diagnostic value and could be used as biomarkers in diagnosis. Exosomes and other secretory vesicles have been the focus of extensive research since their initial discovery. Investigating their molecular composition was crucial in unraveling their functional significance in intercellular communication. Exosomes primarily consist of lipids, proteins, and nucleic acids, each component playing a distinct role in their biological function. In this study aims to enable early-stage cancer diagnosis by examining the developments and methods used to collect specific biomarkers of cancer, namely exosomes using microfluid devices. An important step toward bringing these advances from laboratory settings to bedside applications is the integration of point-of-care (POC) diagnostics with microfluid technologies. POC diagnostics have the potential to completely change the way cancer is diagnosed by providing doctors with real-time data, facilitating rapid decision-making, and improving the treatment of patients. To encourage their widespread use in the medical industry, the study focuses on the need to raise physicians 'awareness of the potential of microfluid devices for cancer diagnosis. To maximize the potential of microfluid-based cancer diagnostic tools and to close the knowledge gap between research and clinical application, obstacles must be overcome and cooperation between scientists and medical professionals must be encouraged.

Keywords: Microfluidic, Herpesvirus, Diagnostic, Rapid

102.

A microfluidics approach in cancer diagnosis and treatment

Sahar Ghoflchi[1]

1. Departments of clinical biochemistry, Mashhad university of medical science, Mashhad, Iran.

Abstract: A novel microfluidic system has emerged as a dependable and user-friendly innovation, poised to enhance the precision of predicting treatment responses in oncology. This breakthrough in microfluidic technology is set to revolutionize personalized therapeutic planning, with a strong probability of optimizing patient care. The device has been pivotal in revealing unanticipated properties of cancer cells, particularly concerning their migratory behavior. These microfluidic devices have undergone rigorous clinical testing and are beginning to bridge the gaps caused by differing biological contexts and the challenges that arise when transitioning from research to real-world clinical settings. Traditional animal testing, although widely utilized, is increasingly recognized for its shortcomings in forecasting human responses to treatment. Conversely, the advancements in in vitro engineered models are showcasing their potential for higher fidelity in reflecting actual clinical scenarios. Such progress underscores the importance of integrating microfluidic systems into the preclinical evaluation phase, providing tailored drug screening and facilitating the advancement of personalized medicine.

Organs-on-chips constitute sophisticated platforms where either engineered or naturally derived minuscule tissues are cultured within microfluidic chips. These chips are specifically designed to regulate cellular microenvironments and to support the preservation of tissue-specific functionalities, thereby providing a more accurate representation of human physiological responses. Astolfi et al. demonstrate the viability of employing micro-dissected tissues (MDT) on chip methodologies for assessing the sensitivity of human cancer tissues to chemotherapy. This innovative approach holds promise for identifying patients likely to benefit from specific treatments at an early stage. It also facilitates the direct examination of the effects of pharmaceuticals on patient-derived tissues during the preliminary phase of drug development, potentially leading to enhanced rates of therapeutic success as indicated in reference.

The purpose of this analysis is to integrate novel nanoparticle formulations developed through microfluidic technology with advanced cancer detection techniques employing microfluidics and organ-on-chip systems. This integration is crucial to formulating a multidisciplinary approach to cancer management that effectively covers both the detection and therapeutic aspects of the disease.

Keywords: Microfluidic system, Organs-on-chips, Cancer

103.

Cancer on-a-chip: model for study breast cancer metastasis to bone

1st Hanieh Rahimi 2nd Mona navee-nigjeh

1. Department of Pharmaceutical Biomaterials and Medical Biomaterial Research Center, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

2. Department of Pharmaceutical Biomaterials and Medical Biomaterials Research Center, Faculty of Pharmacy, Tehran University of Medical Sciences (TUMS), Tehran, Iran

Abstract: Cancer metastases are a challenge for cancer treatment due to their organ specificity and pathophysiological complexity. Over many years, the basic biological mechanisms of breast cancer initiation and progression, as well as the subsequent metastatic cascade, have been studied using cell cultures and animal models. These models, although extremely useful for delineating cellular mechanisms, are poor predictors of physiological responses, primarily due to lack of proper microenvironments. In the last decade, microfluidics has emerged as a technology that could lead to a paradigm shift in breast cancer research. With the introduction of the organ-on-a-chip concept, microfluidic-based systems have been developed to reconstitute the dominant functions of several organs. These systems enable the construction of 3D cellular co-cultures mimicking in vivo tissue-level microenvironments, including that of breast cancer. Several reviews have been presented focusing on breast cancer formation, growth and metastasis, including invasion, intravasation, and extravasation. Bone metastasis occurs at 70% frequency in metastatic breast cancer. The mechanisms used by tumors to hijack the skeleton, promote bone metastasises, and confer therapeutic resistance are poorly understood. This has led to the development of various bone models to investigate the interactions between cancer cells and host bone marrow cells and related physiological changes. In this study, organ-on-a-chip technology will be used to investigate breast cancer metastasis to bone. This technology can imitate the natural state of the body. The chip consists of three sections of breast tissue, bone tissue and lumen space, and the migration of metastatic cells (MDA-MB-231) from the lumen space to the bone tissue will be investigated on different days using a fluorescent microscope and different techniques. Finally, when the drug doxorubicin passes through the trachea, it will be used to inhibit cancer cells.

Keywords: lab on-a-chip; organ on-a-chip; breast cancer; metastasis; invasion; intravasation; extravasation; bone; microfluidic.

104.

Precision Biosensor for Early S100B Biomarker Detection: A Crucial Tool in Traumatic Brain Injury Diagnosis

Mehrasa Rahimi **Borumand[1], Parisa Kianpour[2], Hamid Akbari Javar[3], Mojtaba Mojtahedzadeh[2], Parviz Noroozi[4], Mazda Rad-Malekshahi[1], Fatemeh Babaloii[1], Amirmahdi Mojtahedzadeh[5]**

1. *Department of Pharmaceutical Biomaterials, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran*

2. Anesthesia, Critical Care, and Pain Management Research Center, Tehran University of Medical Sciences, Tehran, Iran

3. Department of Pharmaceutics, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

4. Center of Excellence in Electrochemistry, School of Chemistry, College of Science, University of Tehran, Tehran, Iran

5. Medical Student at Semmelweis University, College of Medicine

Abstract:

Background: Elevated S100B levels serve as a reliable biomarker for assessing brain injury severity and prognosis, enabling timely intervention and treatment strategies. Rapid and accurate detection of S100B facilitates early identification of TBI patients at risk of complications, guiding appropriate medical management and improving clinical outcomes. This underscores the significance of developing a serum S100B detection kit tailored for TBI diagnosis and management. Elevated serum levels of S100B have been identified as an specific biomarker for assessing the severity and prognosis of brain injuries and facilitating appropriate therapeutic approaches. Rapid and reliable detection of serum S100B allows for early identification of TBI patients who are at risk of complications, directing proper managements, and improving clinical outcomes.

Method: A three-electrode system was utilized, employing platinum, Ag/AgCl, and glassy carbon electrodes. Surface preparation involved meticulous polishing and sonication, ensuring electrode cleanliness. Measurement methods included cyclic voltammetry and electrochemical impedance spectroscopy using PalmSense® software and ultra voltammetry for effective biosensor evaluation. Various techniques for connecting biological components to transducers were explored, adapting to specific application needs.

Results: Material procurement ensured availability, while optimized electrode design enhanced sensitivity. Surface preparation methods yielded clean electrodes crucial for reliable performance. Measurement techniques like cyclic voltammetry and impedance spectroscopy provided comprehensive insights. Various connection techniques facilitated robust integration of biological components, enhancing efficacy. Overall, the results demonstrate a successful biosensor platform for sensitive S100B biomarker detection.

Conclusion: Considering the importance of personalized medicine, we tried to achieve a biosensor with better sensitivity, selectivity, reproducibility, response time, and accuracy than previous S100B sensing methods by designing a biosensor based on the electrochemical biosensor.

Keywords: **Electrochemical Biosensor**, **S100B, Traumatic Brain Injury**

105.

Optimizing Acid-Suppressing Therapy: Advanced Biosensor for Gastric pH Monitoring in Critically Ill Patients

Fatemeh Babaloii[1], Parisa kianpour[2], Hamid Akbari Javar[3], Mojtaba Mojtahedzadeh[2], Parviz Noroozi[4], Mazda Rad-Malekshahi[1], Mehrasa Rahimi Borumand[1], Seyyed Mohammad Ghasem Mousavi-Kiasari[5], Amirmahdi Mojtahedzadeh [6]

1. Department of Pharmaceutical Biomaterials, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

2. Anesthesia, Critical Care, and Pain Management Research Center, Tehran University of Medical Sciences, Tehran, Iran

3. Department of Pharmaceutics, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

4. Center of Excellence in Electrochemistry, School of Chemistry, College of Science, University of Tehran, Tehran, Iran

5. Department of Electrical and Computer Engineering, Faculty of Engineering, University of Tehran, Tehran

6. Medical Student at Semmelweis University, College of Medicine

Abstract:

Background: Gastric pH disturbances in critically ill patients signal gastrointestinal issues, requiring prompt monitoring for effective treatment and complication prevention. PH monitoring is one of the pivotal approaches to tailored acid-suppression in these patients. Electrochemical biosensors offer a promising approach for real-time pH measurement due to their sensitivity and specificity.

Method: An electrochemical biosensor was constructed utilizing a potentiometric approach for pH monitoring. This involved employing a working electrode, typically composed of inert and conductive solid materials like platinum or gold, which remain unaffected by redox reactions but exhibit sensitivity to pH variations. Conductive polymers (CPs), known for their inherent conductivity, were utilized to enhance conductivity. Aniline, pyrrole, and ethylene dioxythiophene (EDOT) monomers were procured and electropolymerized onto the working electrode using the electrochemical synthesis method. Its efficacy, first by buffer with different PH, then with real gastric juice was checked and calibrated.

Results: The synthesized CPs demonstrated excellent conductivity and efficiency when deposited onto the working electrode. Subsequent testing with various standard buffers and simulated gastric acid buffers revealed their sensitivity to pH changes. Additionally, the CPs exhibited linear potentiometric responses and conformed to the Nernst equation, confirming their suitability for pH monitoring applications in electrochemical biosensors.

Conclusion: The potentiometric electrochemical biosensor, enhanced with conductive polymers, holds promise for real-time gastric pH monitoring in critically ill patients. Its sensitivity, specificity, and adherence to the Nernst equation validate its potential for personalized acid-suppressing therapy.

Keywords: Electrochemistry, Potentiometry, Biosensor, Gastric PH

106.

Design of electrochemical biosensor based on microfluidic systems for detection and measurement of D-Dimer

Masoume Rostami [a,b,1], Kamran Mansouri[c,2], Hossein Derakhshan khah[b,d,3]

a Student research committe,Kermanshah university of medical sciences, Kermanshah, Iran

b Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

c Medical Biology Research Center, Health Technology Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

d USERN Office, Kermanshah University of Medical Sciences, Kermanshah, Iran

Abstract: D-dimer is a soluble fibrin degradation product that results from the ordered breakdown of thrombi by the fibrinolytic system. D-dimer has been extensively investigated for excluding the diagnosis of venous thromboembolism (VTE) and is used routinely for this indication. In addition, D-dimer has been evaluated for determining the optimal duration of anticoagulation in VTE patients, for diagnosing and monitoring disseminated intravascular coagulation, and for monitoring other conditions in which the patient is at high risk of bleeding or thrombosis. Therefore, quantitative detection of D-dimer level plays an important role in choosing the appropriate treatment method. Methods such as ELISA and latex agglutination for measuring D-dimer have disadvantages such as time-consuming, expensive equipment, and the need for experts. In this work, a microfluidic-based electrochemical biosensor with high sensitivity and efficiency is presented for the detection of D-Dimer protein. we have tried to prepare a new portable biosensor by integrating two fields of electrochemistry and microfluidic. Using a microfluidic chip provides facilities such as the need for a small amount of sample, accuracy, and reproducibility in the results, elimination of sample preparation steps, miniaturization of the biosensor, etc. On the other hand, the use of electrochemical techniques as a measurement method adds characteristics such as quick response, cheapness, and the possibility of quantifying the results to our biosensor. CuFe-MOF/ Black phosphorus (BP) nanocomposite was used in the design of this biosensor, which has advantages such as high conductivity, high surface area, and high active sites. Then this nanocomposite was functionalized using an aptamer and used as an electrochemical aptasensor for detection. Cyclic voltammetry (CV) and electrochemical impedance spectroscopy(EIS) techniques were used to investigate the aptasensor and this aptasensor (Aptamer-CuFe-MOF/ BP) based on glassy carbon electrode provided good sensitivity and repeatability in detection and measurement. We are confident that this way can achieve better results in the case of paper microfluidic chips.

Keywords: D-dimer, Electrochemical aptasensor, Paper microfluidic chips, Metal-organic framework.

- Bench To Market (Research to Clinic)

107..

Highly Promising Future of Global Pharmaceutical Biomaterials Market

Dr. Nahid Moradi (Assistant Professor of Applied Cell Sciences)

Hematology Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran

Abstract: Pharmaceutical biomaterials refer to materials that are utilized within the field of medicine, especially in pharmaceuticals, to develop drug delivery systems, medical devices and implants, tissue scaffolds, and imaging agents. These biomaterials are pivotal in improving therapeutic outcomes, diminishing the burden of medicines, and enhancing results by enabling precise and targeted drug delivery to specific cells, tissues, or organs.

According to Precedence Research, the global market for biomaterial was USD 135.87 billion in 2022, and is expected to grow at a Compound Annual Growth Rate of 12.3% between 2023 and 2032, reaching an estimated value of USD 431 billion by 2032. The market is driven by government grants, growing demand for medical implants, and increasing attention to regenerative medicine research. Advancements in medical technology and healthcare quality are accelerating its current position. Significant R&D activities are also promoting the market expansion. North America dominates biomaterials market in revenue. Of course, Asia Pacific is expected to have the fastest growth during the forecasted period.

Demand for biomaterial based-implants is driven by the increasing prevalence of chronic musculoskeletal conditions and cardiovascular diseases, which are boosting market growth. Advancements in technology expand the use of biomaterials in fields like tissue engineering and bioengineering. Also, the advent of smart biomaterials boosts revenue in this market. Growing demand for biomaterials that mimic body tissues and accurately perform physiological functions drives market growth.

In 2022, the polymer segment accounted for more than half of the biomaterial market and is anticipated to continue its dominance in the future. For tissue engineering, polymeric biomaterials are essential. Advances in technology, such as surface modification, micro-production, nanotechnology, drug delivery and highthroughput screening are driving the use of polymers in tissue engineering. On the other hand, natural biomaterials are expected to experience the highest growth rate due to their advantages in biocompatibility, biodegradability, and remodeling compared to synthetic biomaterials. By Regional Outlook, in North America: U.S., in Europe: U.K. and in Asia Pacific: China are leading countries for market growth.

The pharmaceutical biomaterials market is set to grow due to demand for effective biomaterials and advancing technologies. Highly promising and competitive growth is expected for the pharmaceutical biomaterials market in the future.

Keywords: Pharmaceutical biomaterials, Market growth, CAGR