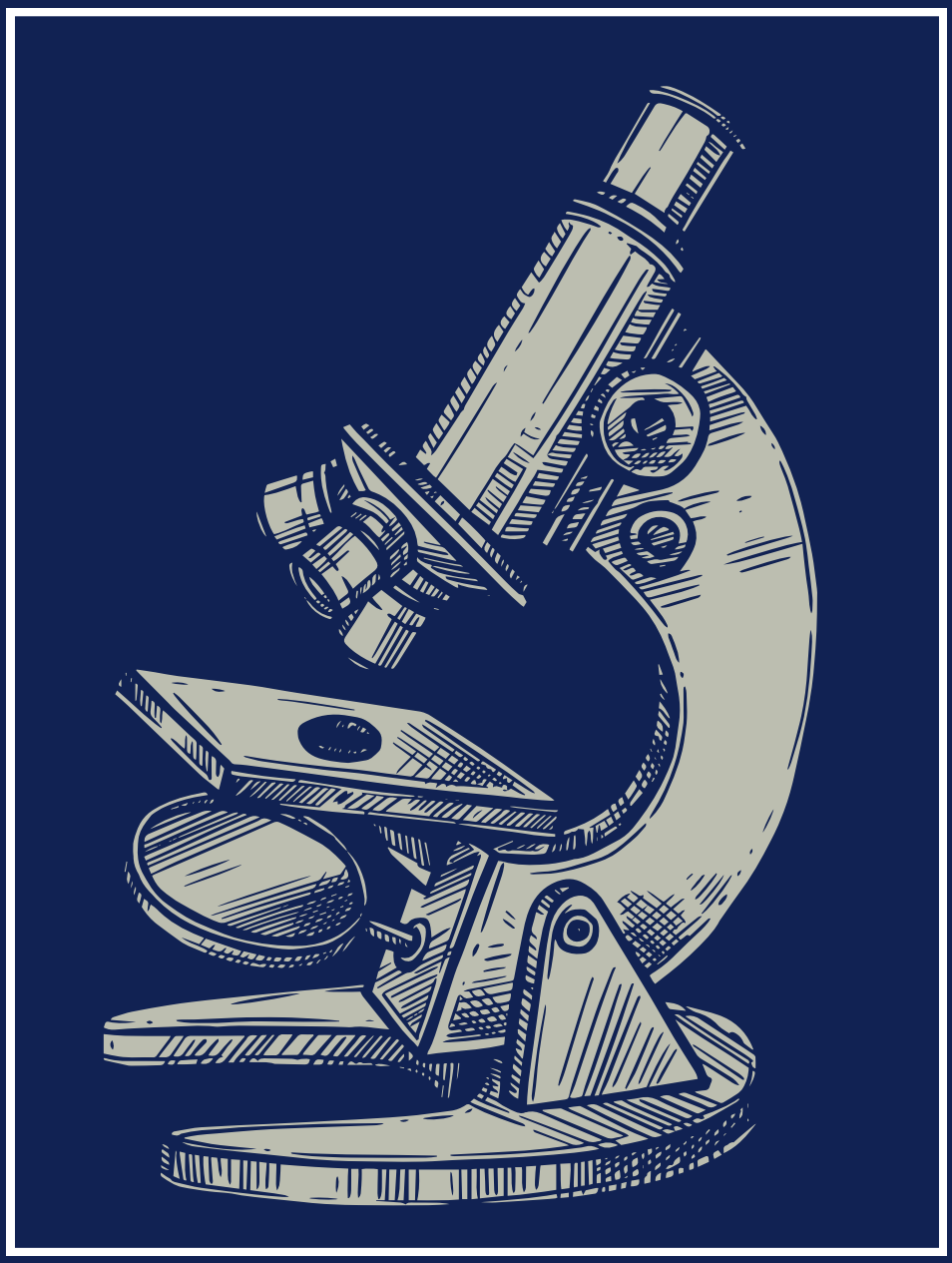
No.8- June 2025

INFINITY

SCIENTIFIC ASSOCIATION OF MEDICAL LABORATORY SCIENCES_VARASTEGAN INSTITUTE FOR MEDICAL SCIENCES



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No.8- June 2025

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Director-in-Charge:
Mahdieh Sadat Hosseini Nezhad

Editor-in-chief:
Nazanin Zeinab Arefipour

Cover and page designer:
Arefeh Roudi

Editors:
Mahdieh Sadat Hosseini Nezhad
Nazanin Zeinab Arefipour

Announcer:
Pouya Gharavi

Authors:
Saman khaleghi moghadam, Setayesh Jabbari, Mahta Ranjkeshzadeh, Sarah Rahmani, Pouya Rahimi, Yeganeh Jahandideh, Farzaneh sadat Noferesti, Sara Eskandari, Nastaran Tavabaki, Negar Hamidfar, Maryam Rohbakhsh Faalnezhad, Kiana Charoghdoozy, Saleh Attar Raouf, Melika Hosseinpour, Arezoo Ezanlo, Mohammad Erfan Arbab, Mohammad Reza Babapour, Parisa Nezafati, Shiva Hafezi Ahmadi, Hoda Rivandi, Mobina Kashki, Mahsa Zarei

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DIRECTOR-IN-CHARGE

A New Milestone in Laboratory Sciences

As we present the eighth edition of the only English-language journal in laboratory sciences, we acknowledge the ongoing dedication of our contributors and the invaluable support of our community.

In an era of rapid scientific advancement, our mission remains to deliver timely and impactful research that enhances the knowledge and practice of laboratory sciences, supporting the scientific community in meaningful ways.

We extend a sincere invitation to professors, students, researchers, and professionals in the life sciences to collaborate with us on upcoming issues.

Sincerely,

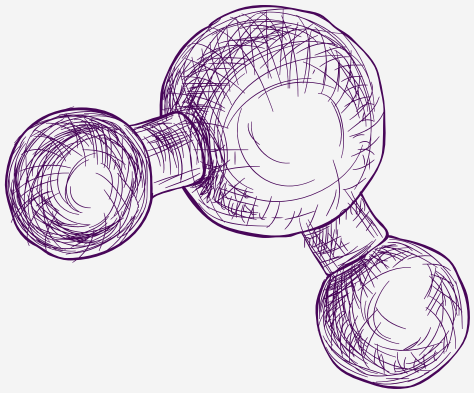
MAHDIEH SADAT HOSSEINI NEZHAD

EDITOR-IN-CHIEF

Welcome to Infinity – Where Science Meets Curiosity

In the ever-expanding universe of laboratory sciences, Infinity is your portal to discovery. From the smallest molecule to the grandest innovation, we explore the limitless possibilities that shape the future of diagnostics, research, and life itself. Join us as we decode the language of science—one issue at a time.

NAZANIN ZEINAB AREFIPOUR



BIOCHEMISTRY

No.8- June 2025

The Role of Hsp70 in Colorectal Cancer:

FROM MECHANISMS OF ACTION TO A THERAPEUTIC TARGET

Colorectal cancer (CRC) is among the most common cancers worldwide. Despite dramatic advancements in the diagnosis and treatment of CRC, it remains a leading cause of cancer-related mortality. Heat shock protein 70s (Hsp70s) are evolutionarily conserved proteins that play a central role in cellular homeostasis and survival.

The 70-kDa heat shock protein (Hsp70) family consists of molecular chaperones that regulate intracellular processes such as protein folding, modification, transport, apoptosis, and cell survival. Hsp70 is expressed at higher levels in cancer cells than in normal cells and may be implicated in tumorigenesis and drug resistance to chemotherapy.

Hsp70 overexpression in CRC has been noted and is associated with poor prognosis. Overexpression of Hsp70 on the surface of CRC cells promotes tumor migration and invasion, while serum Hsp70 has the potential to serve as a biomarker for early detection of CRC.

GRP78, a member of the Hsp70 family, is a key player in CRC. It is found in greater amounts in tumor tissue than in normal tissue, and high levels of anti-GRP78 antibodies have been detected in CRC patients. GRP78 acts as a receptor for ligands and may be a therapeutic target.

The search for Hsp70 inhibitors has yielded adenosine-derived compounds like VER-155008 that block NBD-SBD interaction. Dihydropyrimidine derivatives are one class of Hsp70 inhibitors that block Hsp70 ATPase activity. Several systematic efforts have been made to enhance the efficacy and bioavailability of Hsp70 inhibitors by synthesizing and designing new analogs, derivatives, or nano-formulations, such as MAL3-101 analogs, including DMT3132, DMT3024, and MAL2-11 B. To date, the majority of studies evaluating Hsp70 inhibitors as anticancer agents have been conducted in vitro.

However,

In addition to numerous studies showing that Hsp70 inhibitors are effective in CRC treatment, growing evidence suggests the potential of Hsp70 inducers in preventing CRC. While Hsp70 inhibitors are useful for the treatment of CRC after its establishment, inducers may be effective in preventing CRC in inflammatory and precancerous conditions in the gastrointestinal tract, such as inflammatory bowel disease (IBD), although their effects need to be validated in clinical trials.

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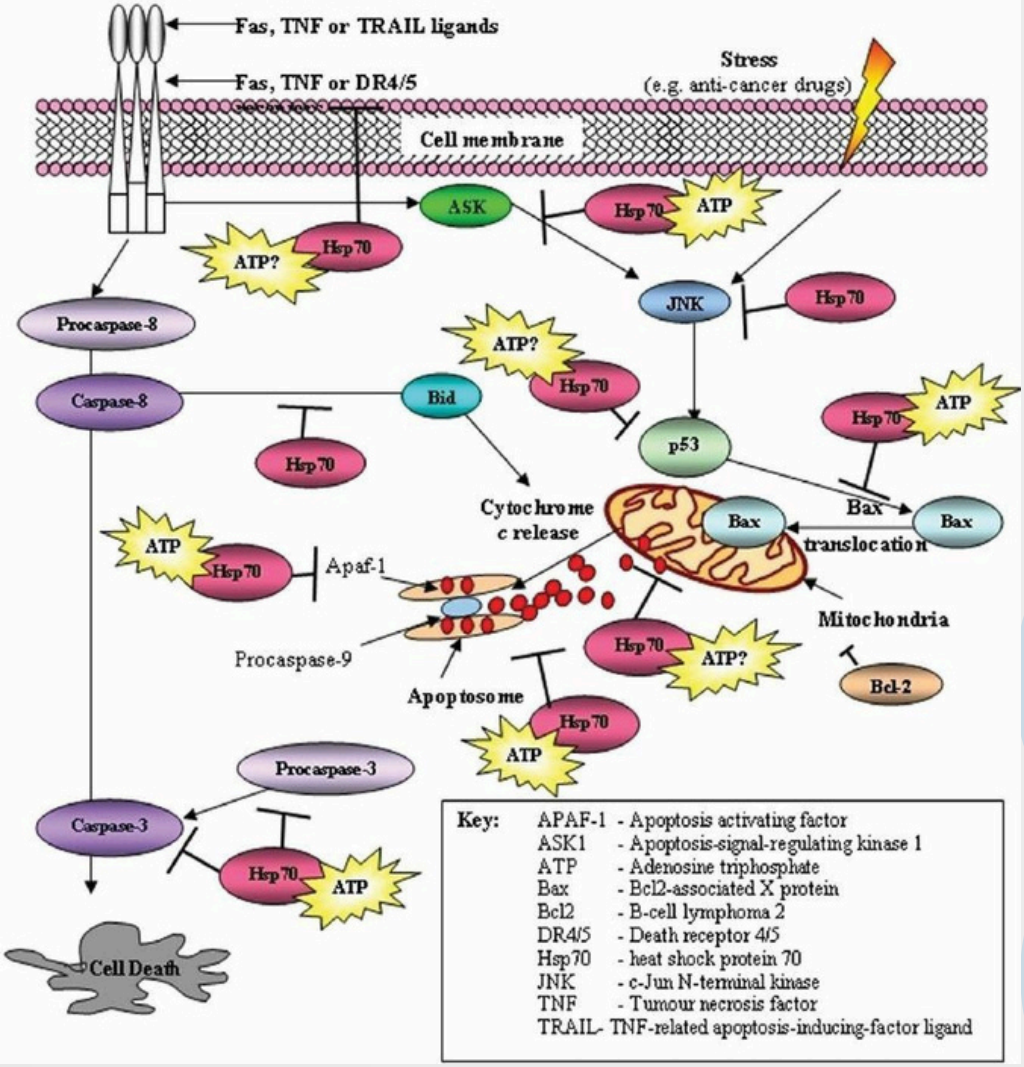

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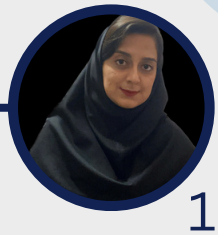
Saman Khaleghi Moghadam

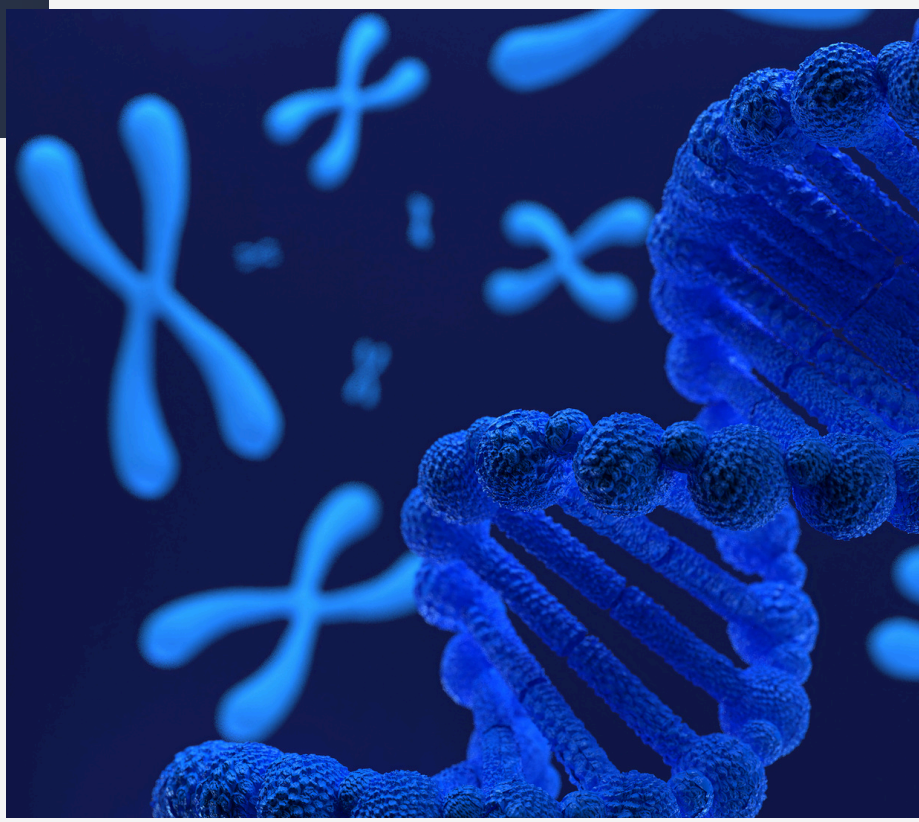
Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Setayesh Jabbari

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran



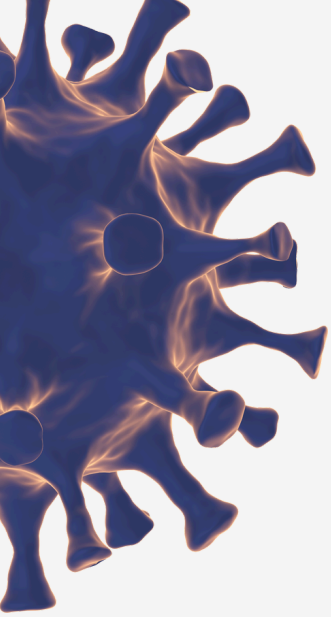
ZIF PROTEINS ON CANCER CELLS' METABOLISM AND TREATMENT RESISTANCE

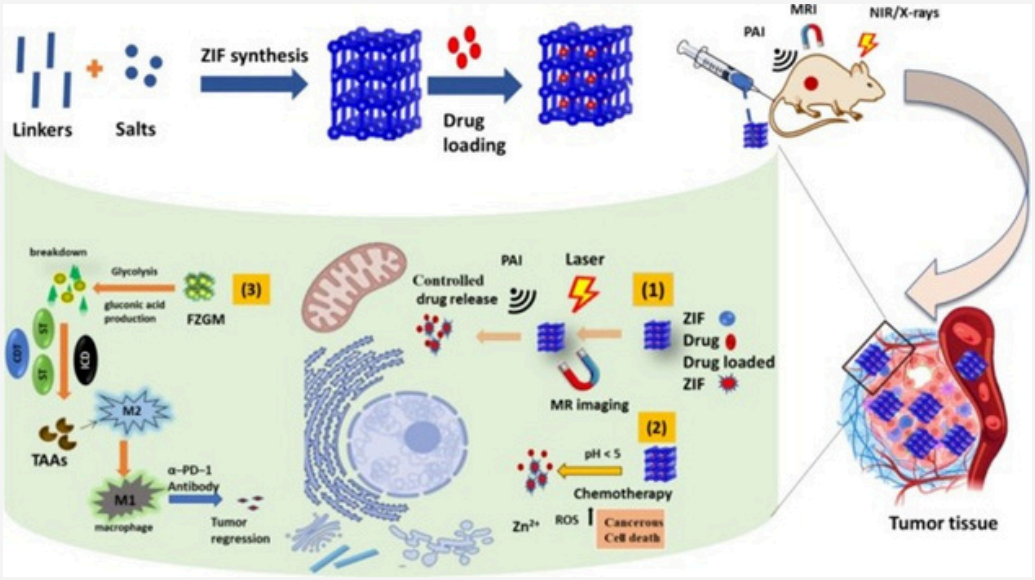


Zeolitic imidazolate frameworks (ZIFs), a subclass of metal-organic frameworks (MOFs), are distinguished by their high porosity, tunable physicochemical properties, and capacity for chemical modification. These characteristics make them highly attractive for a variety of applications, particularly in nanoparticle assembly and therapeutic delivery systems. In the biomedical field, ZIFs have emerged as efficient nanocarriers for drug delivery due to their structural versatility and biocompatibility.

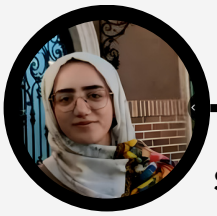
Beyond their use in targeted drug release, ZIFs have also been explored for diagnostic imaging and have demonstrated the ability to facilitate tumor cell targeting and release, positioning them as key players in the development of next-generation anticancer drug delivery platforms.

MOFs encompass a diverse family of materials, including subclasses such as covalent organic frameworks (COFs), metal-organic polyhedra (MOPs), pillared-layer MOFs, and notably, ZIFs. In ZIFs, imidazolate linkers (Im) coordinate tetrahedrally with metal ions, typically zinc or cobalt, sourced from metal salts such as zinc acetate, zinc nitrate, or cobalt nitrate. The nitrogen atoms of the imidazole rings act as bridging ligands, giving rise to robust three-dimensional frameworks with zeolite-like topologies.



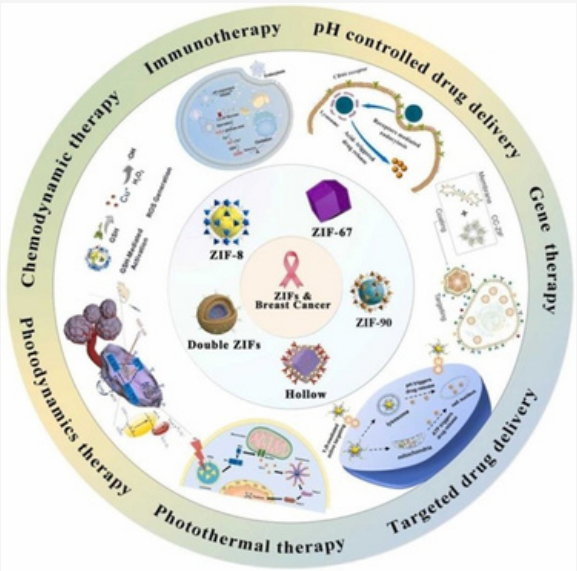


Metal-organic frameworks (MOFs) present a wide range of opportunities for the design of drug delivery systems. Their architecture allows organic ligands to act as drug carriers, metal ions to serve as coordination nodes, and self-assembly via ligand-metal interactions to generate highly tunable structures. These frameworks exhibit excellent biocompatibility, biodegradability, high cytotoxicity toward cancer cells, and minimal toxicity to normal cells. Among them, zinc-based MOFs (Zn-MOFs) have demonstrated great potential in integrating therapeutic and diagnostic functions (theranostics). They can simultaneously facilitate single or combined cancer therapies along with imaging techniques such as magnetic resonance imaging (MRI), thus enhancing both the precision and efficacy of tumor treatment.



Mahta Ranjkeshzade

Department of Medical Laboratory Sciences, Azad University of Urmia, Urmia, Iran



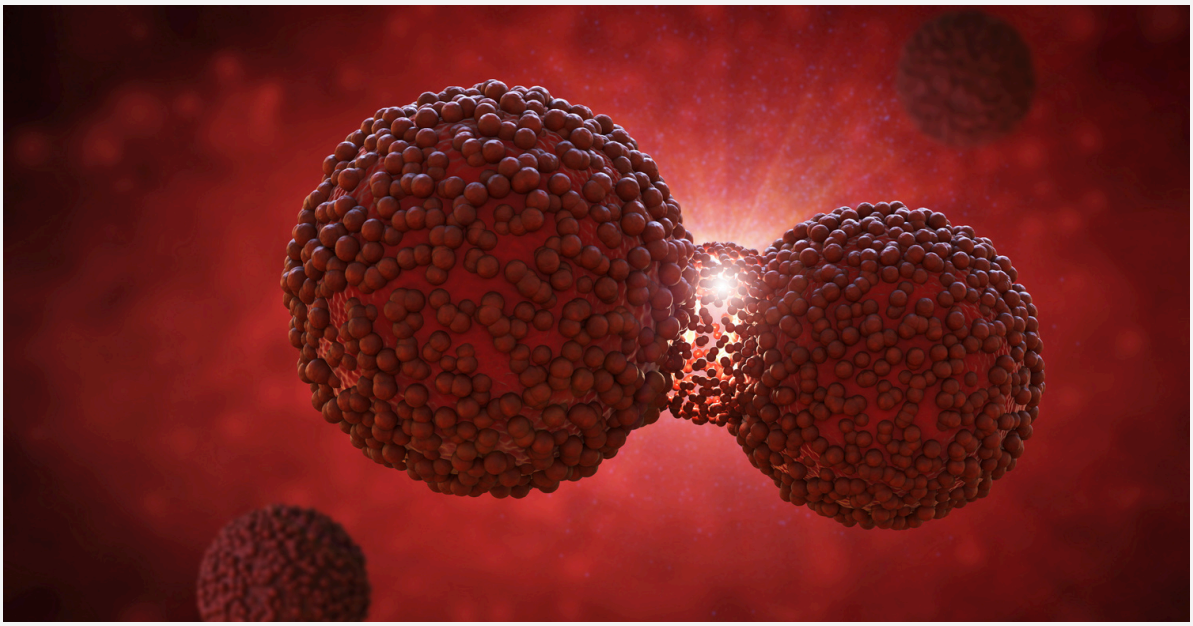
HEMATOLOGY

No.8- June 2025

1. **Multiple myeloma cell-derived exosomes promote favorable tumor functional performance by polarizing macrophages toward M2-like cells**

2. **The potential clinical relevance of procoagulant microparticles as biomarkers of blood coagulation in breast cancer**

Multiple myeloma cell-derived exosomes promote favoral tumor functional performance by polarizing macrophage toward M2-like cells



Abstract

Multiple myeloma (MM) is a bone marrow malignancy characterized by the endogenous, uncontrolled growth of plasma cells. The tumor microenvironment (TME) is highly essential for disease progression. The exosomes play a pivotal role in mediating cell-cell communication. MM-derived exosomes contain bioactive molecules, such as microRNAs (miRNAs) and various proteins, which influence immune cells, especially macrophages. The exosome generally produces macrophage polarization toward an M2-like phenotype, hence creating an immunosuppressive environment suitable for tumor growth and therapy resistance. Investigation of the molecular mechanism underpinning this phenomenon may give rise to novel therapeutic approaches oriented at exosomal pathways.

Introduction

MM alters the bone marrow microenvironment, hence disrupting normal immune function. Mainly, macrophages are immune cells that are influenced by the above switches to and fro from M1 (pro-inflammatory, anti-tumor) and M2 (anti-inflammatory, pro-tumor). Oncogenic miRNAs and other signaling molecules in MM-derived exosomes downregulate anti-tumor immunity by crossing into macrophages and triggering pathways that propagate this shift. Thus, they promote immunosuppression, angiogenesis, and survival of tumor cell populations, all of which work together to enhance macrophage function.

Exosomal-modulated Macrophages

The exosomes from MM promote activation of pathways like STAT3 and PI3K/AKT in macrophages and M2 biasing within the exosomes, thereby leading to increased production of IL-10 and TGF-β, both well-known inhibitors of cytotoxic immune responses. Furthermore, such macrophages secrete VEGF, inducing angiogenesis and essentially maintaining the tumor. These exosomes of MM create an environment that proves supportive for malignant plasma cells by modulating the immune landscape.

Conclusion

Conclusion

MM exosomes play a major role in reshaping macrophages into tumor-supporting cells, which contribute significantly to immune evasion. Novel therapies targeted at exosomal pathways may enhance anti-tumor immunity and patient benefits in MM. Further work is required to develop effective interventions to disrupt such interactions mediated by exosomes.

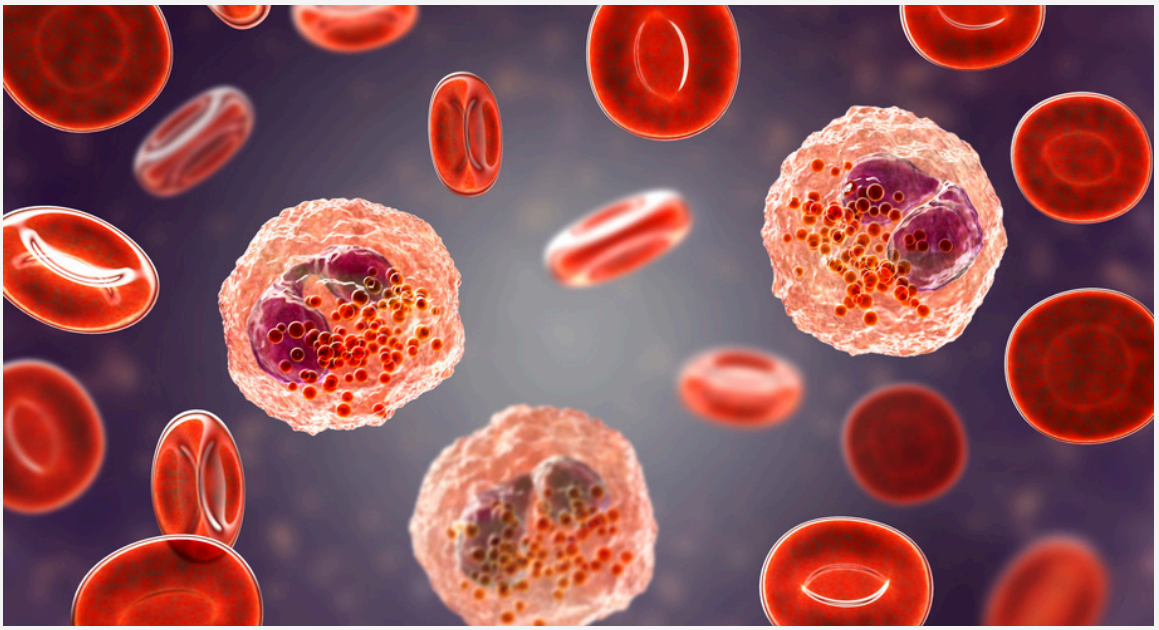
Pouya Rahimi

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Sarah Rahmani

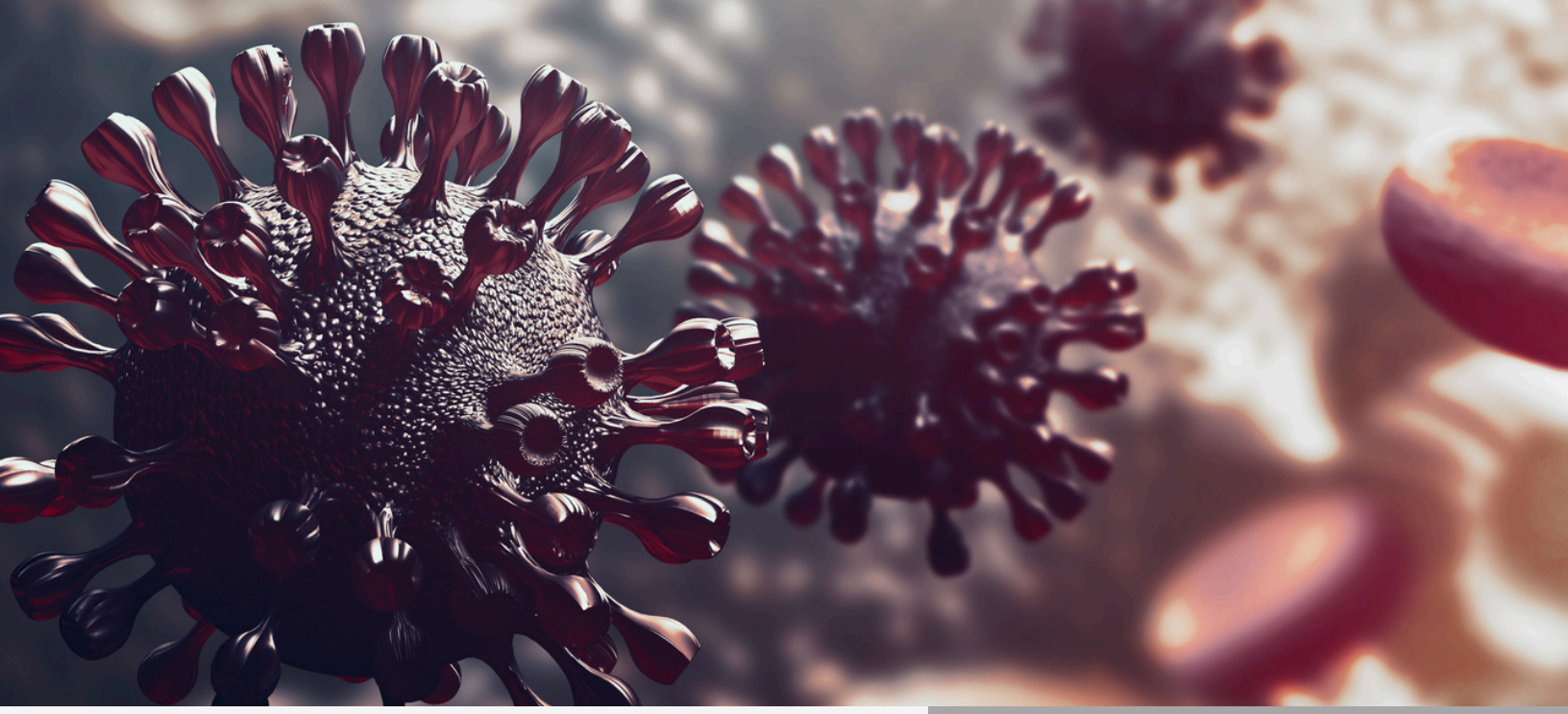
Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

The potential clinical relevance of procoagulant microparticles as biomarkers of blood coagulation in breast cancer



Introduction

The most common invasive cancer diagnosed in women globally is breast cancer, which also ranks second in terms of cancer-related deaths, after lung cancer. Blood biomarkers are a convenient, non-invasive method of identifying people with breast cancer that is also widely accepted, reasonably priced, and easily repeatable when compared to invasive diagnostic techniques like core biopsy. Blood-based biomarkers for breast cancer include carcinoembryonic antigen (CEA), cancer antigen (CA)15-3, urokinase plasminogen activator (uPA), and breast cancer antigen (BRCA).In Iran, 16967 BC were identified in 2020, and 4810 of those individuals passed away. Out of all the types of cancer, this one had the greatest incidence. Patients with breast cancer had an average age of 31–73 years, which was not much different from that of the healthy controls, who were 29–64 years old.



About microparticles

When cellular activation and death occur, a variety of cells, including platelets, red blood cells (RBCs), leukocytes, and endothelial cells, release membrane-derived microparticles (MPs), which are tiny vesicles (0.1–1.0 μm) from their surface. The levels of circulating MPs are rising in a variety of cancers, such as BC, ovarian, colorectal, and hematologic malignancies. Research has indicated that MPs play a role in the development, spread, and metastasis of cancer. Additionally, according to a different study, PMPs might significantly affect the pathophysiology and prognosis of BC.

Metabolic Plasticity Induced by PMPs

PMPs were associated with notable metabolic plasticity and the release of mito MPs-packaged mitochondria. This finding suggests a potential link between MPs and cancer-aggressive processes, implicating them in tumor metabolism and progression.

Association of MPs with BC Characteristics

Patients with BC exhibited a significantly higher rate of PMPs compared to normal subjects ($P<0.001$). Additionally, significant and positive correlations were observed between MPs levels and tissue-based biomarkers, tumor grading, and distant metastasis ($P<0.05$), indicating the potential clinical relevance of MPs as biomarkers in BC.

MPs and Chemotherapy-Induced Change

BC patients treated with paclitaxel chemotherapy showed increased levels of CD44-expressing tumor-derived MPs ($P<0.001$). Additionally, lower levels of MPs were observed before neo-adjuvant chemotherapy, indicating a potential influence of chemotherapy on MPs levels.

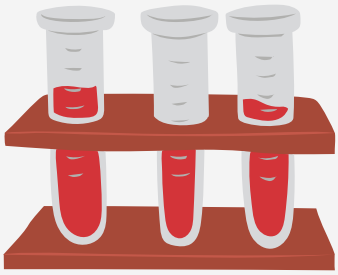
MPs Correlation with Thrombin Generation
Thrombin generation in plasma was found to be associated with the level of MPs, highlighting the potential link between MPs and thrombotic events

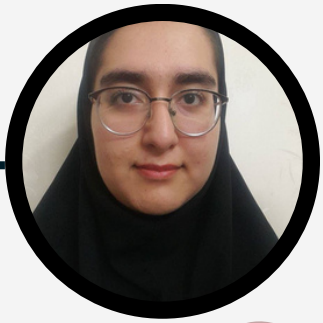
Conclusions

Microparticles (MPs) play a critical role in breast cancer (BC) progression, diagnosis, treatment response, and thrombotic risks. Elevated MPs correlate with tumor aggression, metastasis, and chemotherapy-induced changes, making them potential biomarkers and therapeutic targets.

Yeganeh Jahandideh

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran





Farzaneh sadat Noferesti

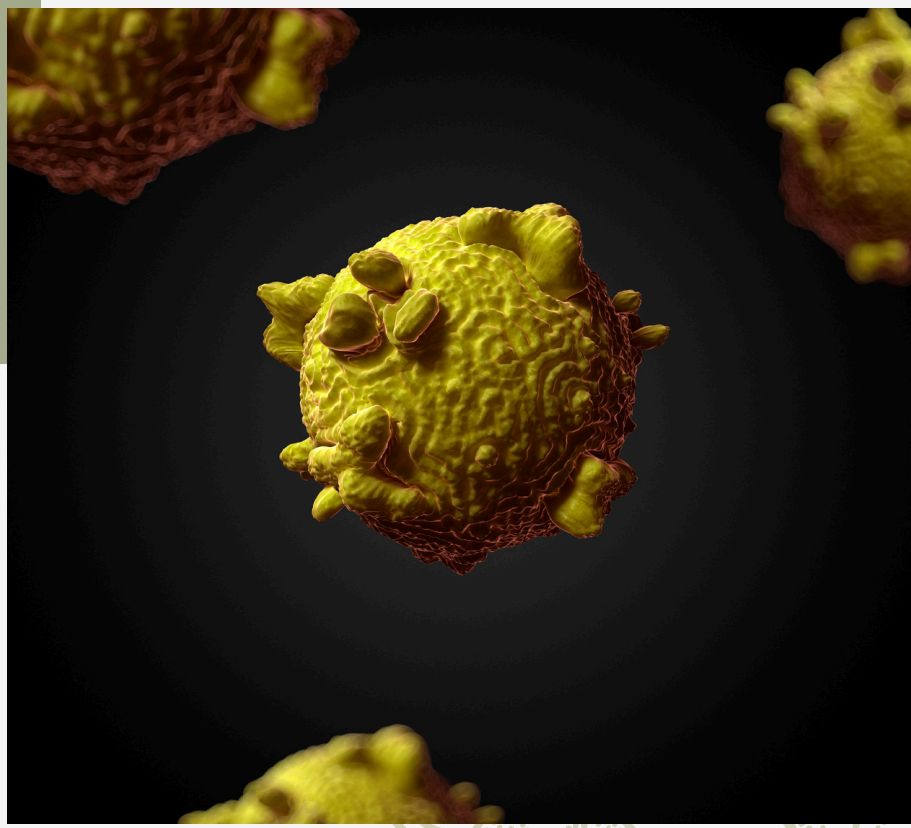
Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

IMMUNILOGY

No.8- June 2025

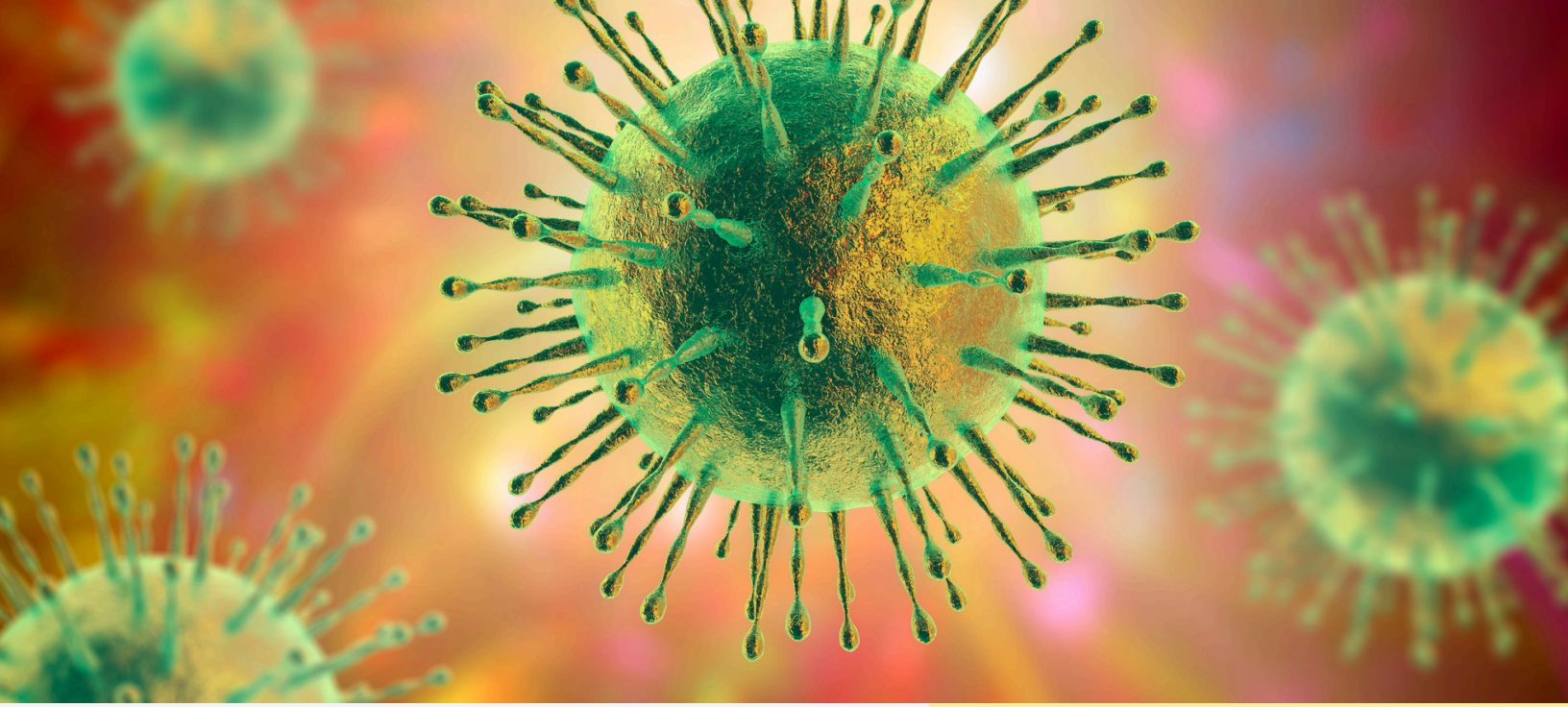
αβ T-cells vs. γδ T-cells:

Evaluating the Efficacy and Safety of CD34-Specific Bispecific T-cell Engagers in AML Therapy



Introduction

Acute Myeloid Leukemia (AML) is still a malignancy due to its high rate of resistance to conventional chemotherapy. Bispecific T-cell engagers (BiTEs) have been developed as a promising immunotherapy by redirecting T-cells against AML cells. While αβ T-cells are the major effectors of adaptive immunity, γδ T-cells provide MHC-independent tumor immune surveillance. Acknowledging their unique functions in AML treatment is pivotal to the optimization of CD34-targeted BiTEs for enhanced efficacy and safety.



Mechanism of Action

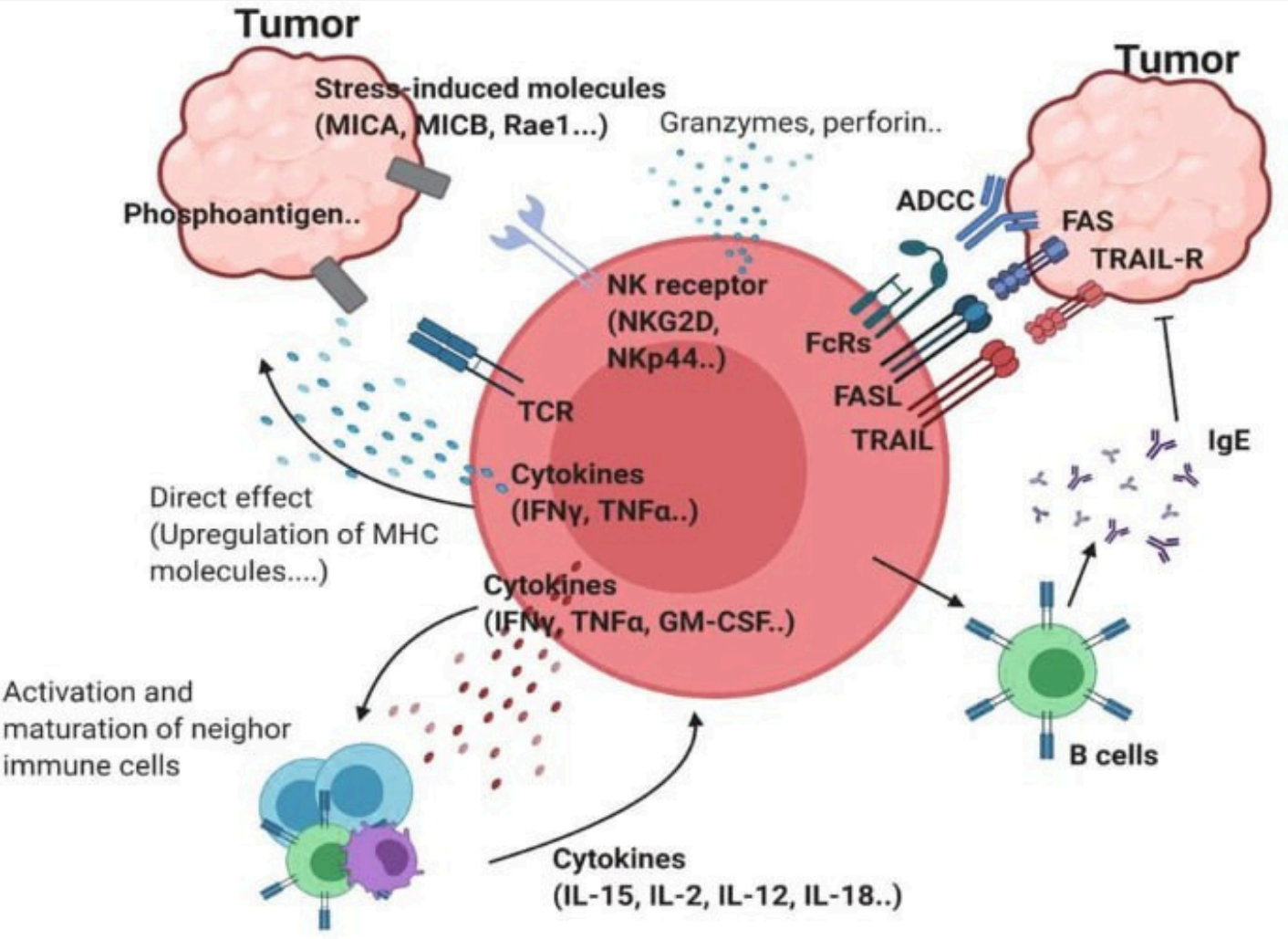
Given the significant advancements in AML treatment and the use of CD34+ leukemic stem cells, it has been shown that a novel CD34-directed bispecific T-cell engager (BiTE) can redirect T-cell effector function towards cancerous cells. αβ T-cells, with antigen-specific activity, are extremely cytotoxic but may lead to graft-versus-host disease (GVHD). However, its impact on (gamma, delta) T-cells remains unclear, considering the low frequency of gamma-delta T-cells in peripheral blood.

Efficacy Comparison

αβ T-cells were found to possess potent anti-leukemic activity but rely on antigen presentation, thus limited by their potential efficacy in AML's heterogeneity. In contrast, γδ T-cells possess inherent tumor recognition and improved ability to infiltrate solid and hematological malignancies. Armed with CD34-BiTEs, γδ T-cells may provide a prolonged cytotoxic activity with reduced immune evasion. In addition, BiTEs, when combined with cytokine modulation or checkpoint inhibition, enhance the function and persistence of γδ T-cells, which makes them a great candidate for AML immunotherapy.

Safety Profile

Using this method for cancer treatment, despite all of its advantages, has its risks. CD34 is expressed on normal progenitors, so using CD34-targeted BiTEs may cause toxicity to stem cells. αβ T-cells have a role in cytokine release syndrome (CRS) that can increase the risk of systemic inflammation. However, γδ T-cells are a safer option because their mechanism is more like the innate immunity, and they have a lower risk of causing GVHD or CRS. Fortunately, there are solutions such as binding affinity, which can reduce the risks in this approach.



MPs Correlation with Thrombin Generation

Thrombin generation in plasma was found to be associated with the level of MPs, highlighting the potential link between MPs and thrombotic events

Conclusion

Currently, researchers have made limited progress in cellular therapies for acute myeloid leukemia/refractory to treatment (AML). Various phase 1 trials of single antigen-targeted CAR T-cell therapies have been established worldwide. Although upfront regimens and disease status not only affect the performance of progenitor cells but also impact engraftment kinetics, the number of CD34+ cells and re-infusion is the main predictor of hematopoietic recovery, and engraftment is mostly successful.

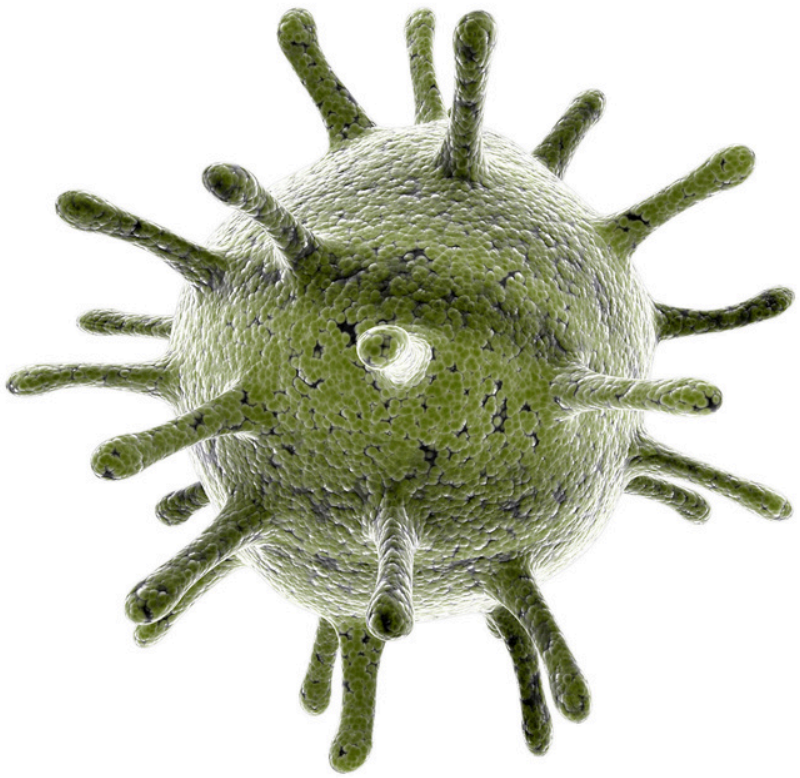
Sara Eskandari

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Nastaran Tavabaki

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Efficacy of Mesenchymal Stem Cells on Systemic Lupus Erythematosus Treatment



Mesenchymal stem cells (MSCs) are multipotent cells that can be extracted from various sources and differentiate into multiple cell types. They have been used to treat various illnesses, including autoimmune disorders, diabetes, Crohn's disease, irritable bowel syndrome, heart injuries, inflammatory ailments, and organ transplants due to their immunomodulatory and regenerative properties. Research has focused on MSCs because of their immunomodulatory properties, which allow them to reduce chronic inflammatory disorders.They have been used to treat 14 conditions in clinical trials, including autoimmune illnesses.

Systemic lupus erythematosus
Many studies have examined the application of MSCs as a treatment in animal models of systemic lupus erythematosus and rheumatoid arthritis. MSCs have immunomodulatory effects by inhibiting the activation and proliferation of lymphocytes, producing pro-inflammatory cytokines, and reducing the activation and proliferation of autoreactive B cells and specific T cell types. The best animal models for understanding the therapeutic mechanism of MSCs are MRL/lpr and NZB/W F1 mice with Fas mutations. Research indicates that MSCs can delay lupus autoimmunity, reduce autoantibodies, follicular helper T cells, proteinuria, humoral immune components, and SLE's pathogenic and inflammatory immunological response

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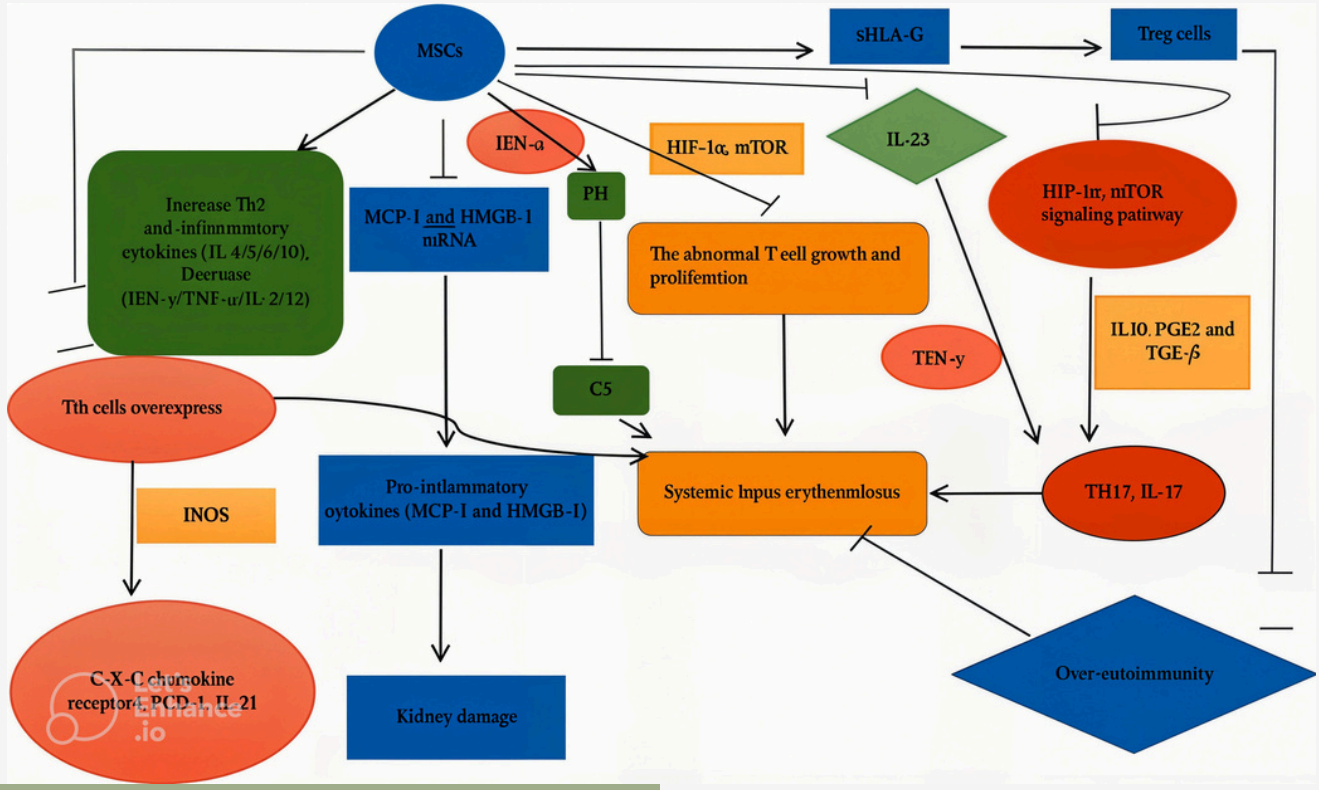
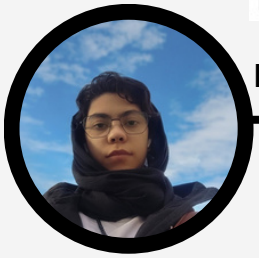
It has been demonstrated that allogeneic MSC transplantation utilizing peripheral blood MSCs lowers serum creatinine levels and proteinuria in SLE patients. Functional problems, however, make it difficult to use autologous MSC-based therapy in practice. It has been shown that allogeneic MSCs derived from bone marrow and umbilical cord can reduce autoimmune disease and improve kidney function.

Efficacy Comparison
αβ T-cells were found to possess potent anti-leukemic activity but rely on antigen presentation, thus limited by their potential efficacy in AML's heterogeneity. In contrast, γδ T-cells possess inherent tumor recognition and improved ability to infiltrate solid and hematological malignancies. Armed with CD34-BiTEs, γδ T-cells may provide a prolonged cytotoxic activity with reduced immune evasion. In addition, BiTEs, when combined with cytokine modulation or checkpoint inhibition, enhance the function and persistence of γδ T-cells, which makes them a great candidate for AML immunotherapy.



Conclusions

Ultimately, stem cell/MSC transplantation is a new treatment option for chronic autoimmune conditions like SLE, RA, and type 1 and type 2 diabetes. Preclinical models of these diseases have aided in the understanding of immunological processes and available treatments. MSC-derived exosomes have shown encouraging results in recent experimental and clinical studies.

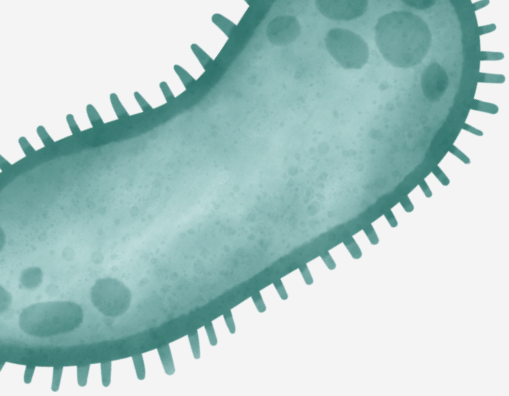


Mithra Rouhbakhsh Faal Nezhad

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Negar Hamidfar

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran



MICROBIOLOGY

No.8- June 2025

Emerging lactic acid bacteria bacteriocins as anti-tumor agents

Cancer is a malignant tumor that is caused by a gene mutation in normal cells. Currently, cancer is the leading cause of death worldwide and a gigantic obstacle to prolonging human life.
At present, researchers are constantly exploring cancer therapies with few side effects, and one of the research interests is the anti-cancer characteristics of lactic acid bacteria (LAB).

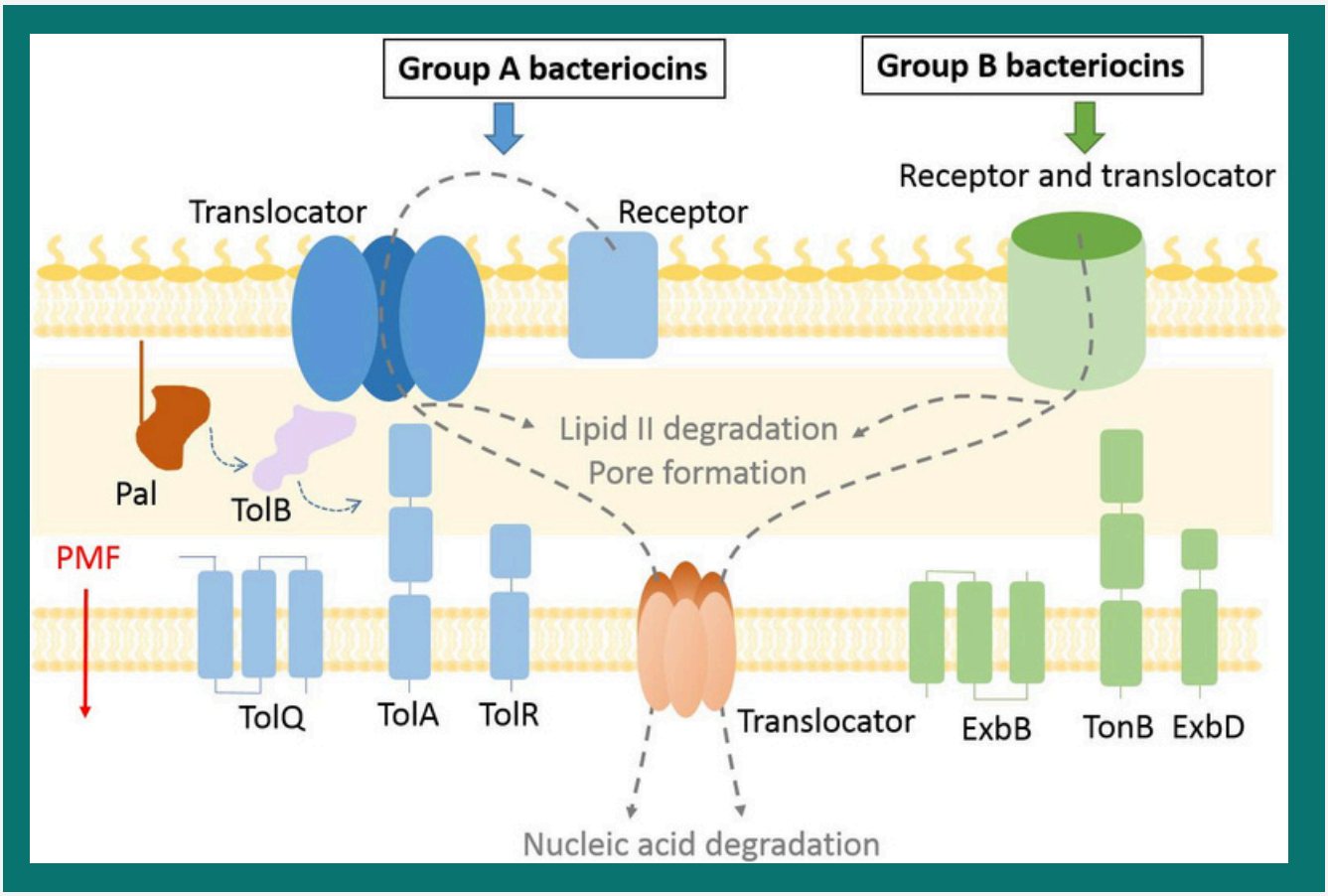
Anti-cancer activity of the lactic acid bacteria
It has been found that lactic acid bacteria have the potential to produce bacteriocins, which could potentially offer a promising alternative for cancer treatment.
LABs can produce a variety of chemicals, some of which can prevent the growth of microorganisms. A few examples of these include lactic acid, acetic acid, and propanoic acid in healthy cells.
Specifically, lactic acid has been demonstrated to be pivotal in molding the tumor microenvironment through its effects on different cell populations.

Lactic acid bacteria bacteriocins as anti-tumor agents

Lactic acid bacteria produce not only a variety of active substances, but they can also produce bacteriocins with antibacterial activity.

Bacteriocin TS is a natural bioactive antimicrobial peptide derived from the fermentation of Lactococcus lactis isolated from traditional dairy products. Its main active ingredient is bacteriocin.

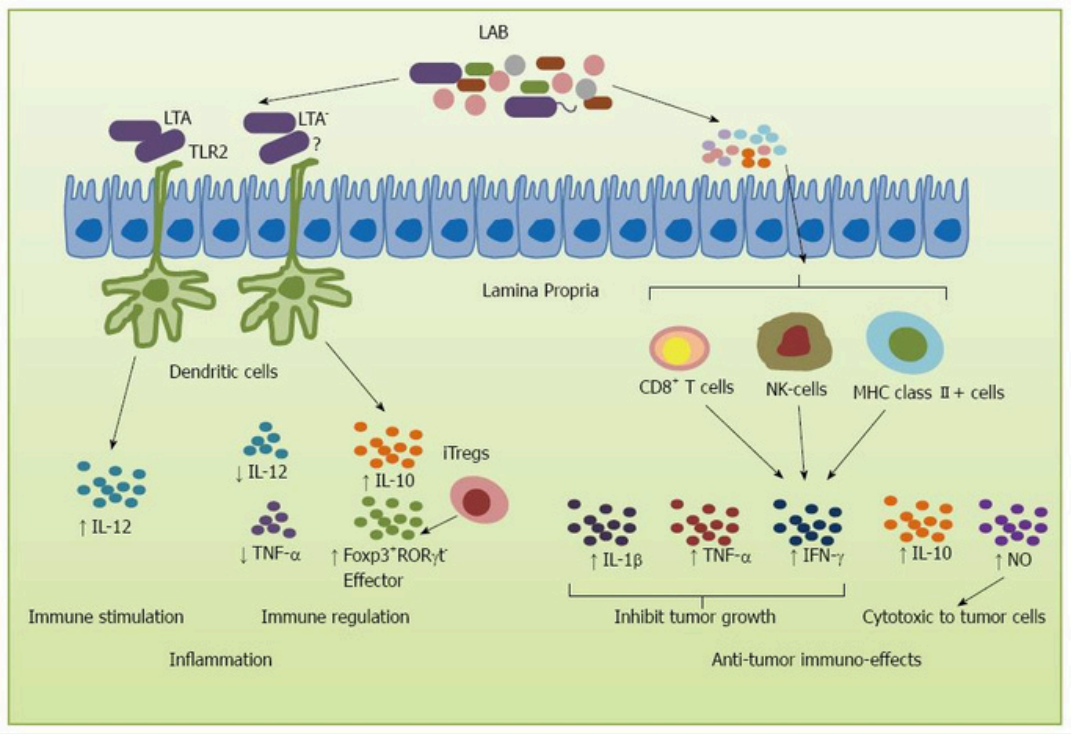
So far, there has been some initial progress in research concerning LAB bacteriocins in food preservation, antibacterial, antiviral, and other fields. Because bacteriocins occur naturally in many foods, the human body tolerates them well without toxicity or allergic reactions, making them a very safe food preservative.



The effect of bacteriocins on cells

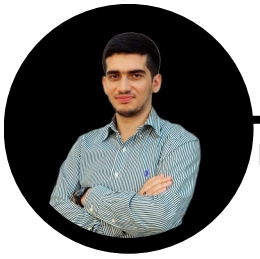
Bacteriocins have been found to have the power to destroy some cancer cells and prevent other cancer cells from infiltrating the body.

It has also been shown that the bacteriocins produced by LAB can affect the immune system; also, some bacteriocins, such as pediocin and nisin, can boost the immune system. This is accomplished by activating a variety of immune cells, such as natural killer cells and macrophages, both of which can aid in the destruction of cancer cells, the most important factors in the progression of cancer.



Immune responses induced by lactic acid bacteria

Bacteriocins produced by LAB have several benefits that set them apart from other types of anti-cancer drugs. They are regarded as safe and well-tolerated by the human body. If more research is conducted on the topic, LAB bacteriocins have the potential to develop into a substantial new class of anti-cancer drugs



Saleh Attar Raouf

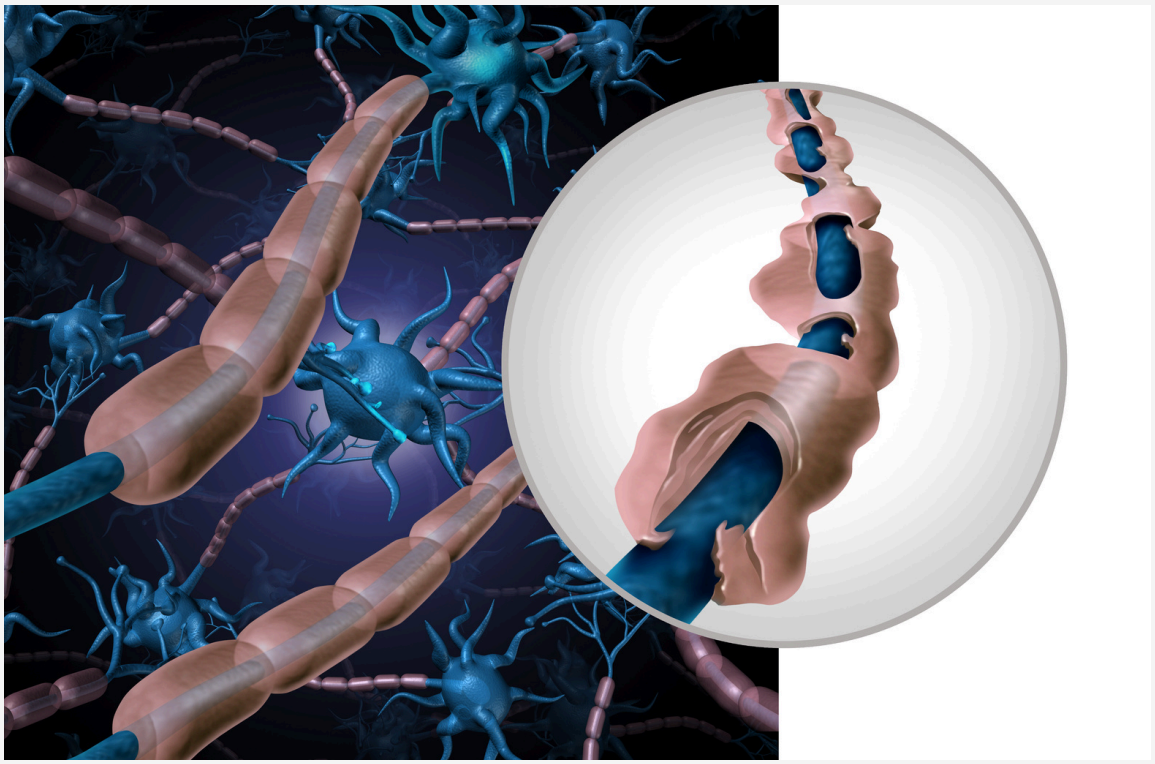
Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Kiana Charoghdoozy

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

The Gut-Brain Axis:

Understanding the Influence of Gut-Microbiota on Multiple Sclerosis



Introduction

Multiple sclerosis (MS) refers to an often-debilitating chronic condition that affects the central nervous system (CNS). It has a hallmark presentation of inflammation, demyelination, and resultant neural tissue degeneration. The gut-brain axis—including the gut microbiota, immune system, and central nervous system—is a key communication network in which gut involvement plays a central role in multiple sclerosis (MS). Symptoms can worsen due to gut dysbiosis or microbiome imbalance, which affects immune modulation. Inflammation modulation through probiotics and diet suggests an active role by the gut in MS advancement.

The Immunologic Function of the Gut-Brain Axis in Multiple Sclerosis

A Microbiota from an intestinal region proved its importance as a modulator of immune and inflammatory responses. Multiple Sclerosis (MS) patients demonstrate gut dysbiosis with an increased abundance of bacteria catabolizing short chain fatty acids (SCFAs) and serotonin, which are immune regulatory depletes. This imbalance perpetuates the neuroinflammation and self-reactive immune processes that define MS.

Preclinical and Clinical Studies Evidence

Findings from models of Experimental Autoimmune Encephalomyelitis (EAE) suggest that the gut microbiome may modify the severity with which patients express MS symptoms. Patients suffering from MS exhibit decreased diversity of microflora along with increased presence of inflammatory bacteria. One clinical trial suggested that inflammation, alongside other clinical signs, was improved when probiotics were taken, indicating that the exacerbation of microbiota may have a role in the management of MS

Therapeutic Investigations: Modifying the Microbiota for MS Treatment

These avenues of exploration include:

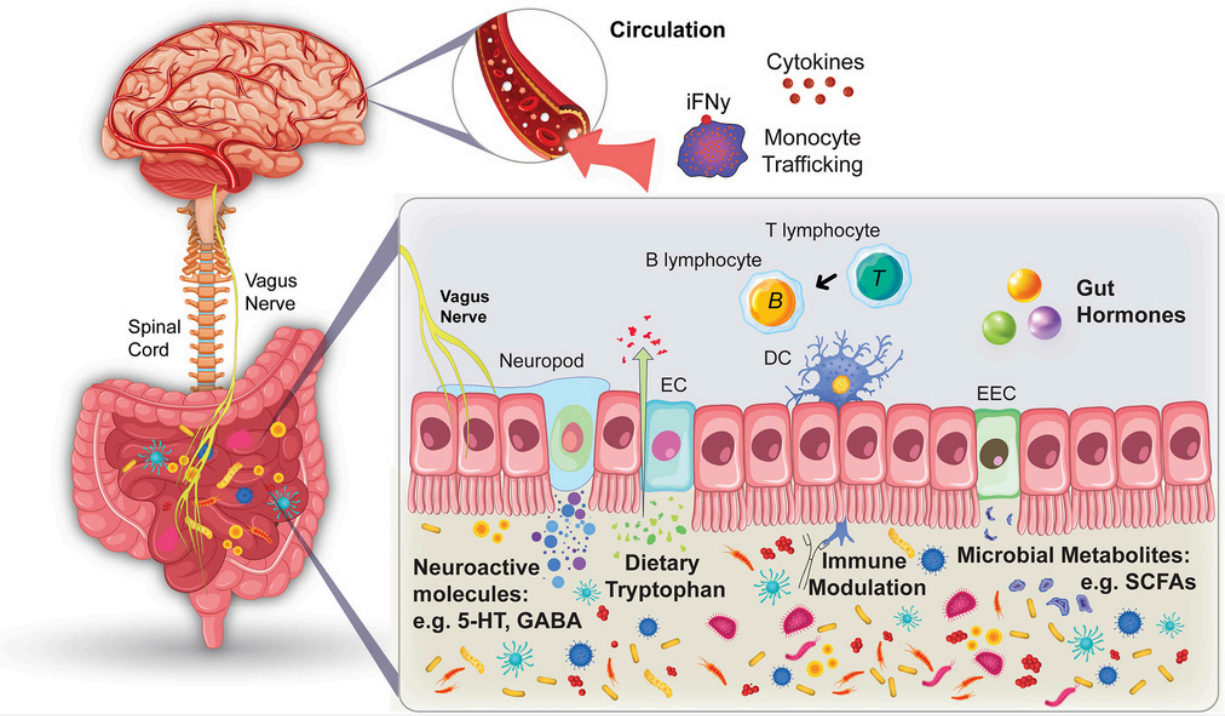
·Prebiotics and Probiotics: Certain microorganisms have beneficial effects and boost the immune response.

Nutritional Therapy: Diets rich in fiber are associated with having greater concentrations of SCFA and lower inflammation.

·Fecal Microbiota Transplantation (FMT): This is an innovative method intended to restore the imbalance within a gut ecosystem.

Conclusion

The evidence regarding the relevance of the gut-brain connection is manifesting itself in MS more and more. Probiotics, dietary changes, and FMT can likely help lessen the inflammation. Research should concentrate on developing microbiota-altering therapies that improve the clinical and functional status, as well as the overall well-being, of the patients.

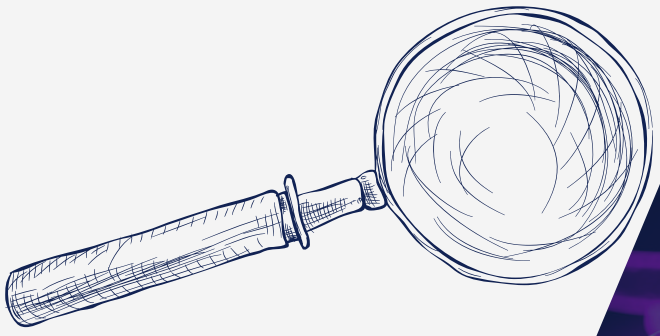


Melica Hosseinpour

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

Arezoo Ezanlo

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran



GENETIC

No.8- June 2025

Epigenomic profiling of the infrapatellar fat pad in osteoarthritis

Introduction: Understanding Osteoarthritis and Its Progression

Osteoarthritis is a disease in which the cartilage between the joints wears away. As the cartilage wears away, the bones come closer together and wear out, and the joint loses its ability to absorb pressure to a great extent. The wear and tear of the bones leads to knee pain, joint swelling, stiffness, and decreased mobility of the joint, and sometimes the formation of bone spurs and deformity of the joint. Factors such as aging, genetic background, obesity, and traumatic injuries are considered to be important risk factors for the development of this disease. Subsequent studies suggest that epigenetic changes also play a key role in the severity and progression of OA. The infrapatellar fat pad (IPFP), which is an internal structure, not only plays a role in reducing mechanical stress but also in the production and regulation of molecules that affect the disease process.

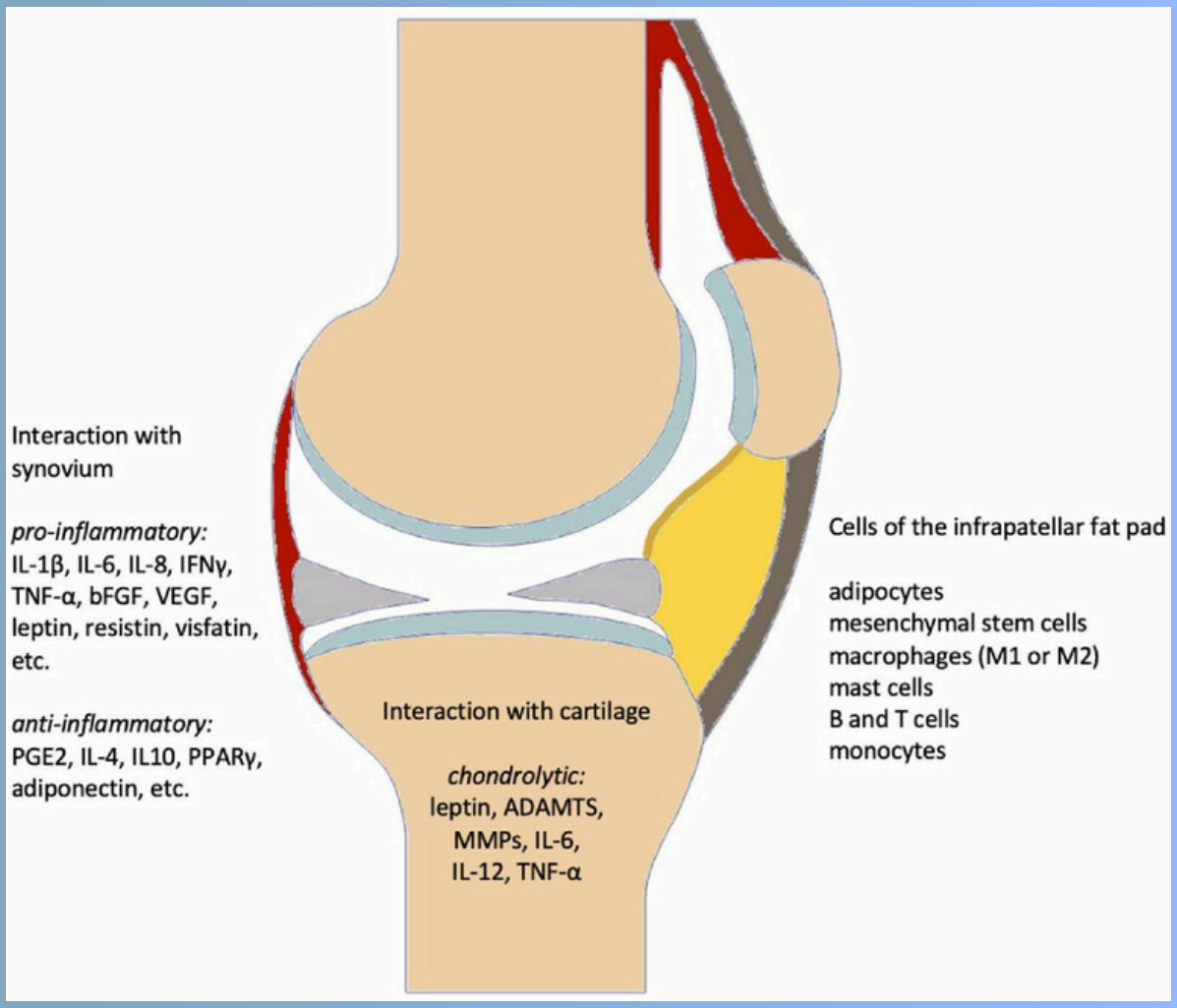
Epigenetic Mechanisms in Osteoarthritis

The term "epigenetics" refers to changes in gene activity that occur without changing the original DNA sequence. Environmental factors such as inflammation, oxidative stress, and metabolic stress play an important role. The three main epigenetic mechanisms involved in OA include DNA methylation, histone modifications, and noncoding RNAs.

Role of the Infrapatellar Fat Pad in OA Progression

These mechanisms alter gene expression and, consequently, traits of an organism without changing the structure or type of nucleotides by adding chemical groups to DNA or histones.

The infrapatellar fat pad (or Hoffa's fat pad) is a cylindrical piece of fat located below and behind the patella and inside the knee. In addition to its mechanical activity, this area plays a significant role in the production of inflammatory cytokines and growth factors such as IL-6 and TNF-α, such that epigenetic changes (such as DNA methylation and histone changes) cause joint destruction and inflammation.



Epigenetic modifications in the infrapatellar fat pad contribute to osteoarthritis by dysregulating inflammatory mediators like IL-6 and TNF-α.

Mohammad Erfan Arbab

Bachelor of Laboratory Sciences, Islamic Azad University, Shahrood Branch, Shahrood, Iran

MohammadReza Babapour Roshan

Bachelor of Laboratory Sciences, Islamic Azad University, Sari Branch, Sari, Iran

A Narrative Exploration of seekRNA's Transformative Role in Genetic Engineering and Therapeutics

A recently developed genetic editing technology may surpass CRISPR-like systems due to its exceptional precision and flexibility. This advancement could revolutionize agriculture, medicine, and biotechnology by expanding the possibilities of genetic engineering. Using a programmable RNA strand, SeekRNA can accurately target specific genetic sites for insertion. This technique enhances the editing process and significantly reduces the risk of errors, offering scientists and clinicians a high level of confidence.

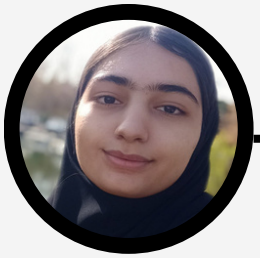
Unlike other tools, SeekRNA does not depend on multiple external components for cutting and pasting actions. It functions as a self-sufficient system, maintaining high accuracy even when working with complex DNA sequences

SeekRNA offers broad therapeutic potential and may improve treatment strategies for various diseases. One key application is its use in correcting mutations responsible for inherited disorders. This precise DNA editing method, including approaches like gene therapy or CRISPR-based repair, enables the replacement or correction of defective genes. This tool can contribute to cancer treatment by targeting and modifying genes involved in tumor growth and metastasis. By altering these genes, SeekRNA may help control tumor progression and enhance therapeutic outcomes.

SeekRNA also supports biomedical research by enabling deeper insights into gene functions and biochemical pathways. For instance, it can reveal how genetic changes influence disease models, improving our understanding of complex conditions. This biotechnology may facilitate the development of advanced therapies, such as immunotherapies that enhance the body's immune response, and more effective treatments for infections and other diseases. Given its precision in gene editing, SeekRNA also promotes the advancement of personalized medicine. By analyzing individual genetic profiles, it enables tailored treatment strategies, potentially increasing the success of recovery.

In summery,

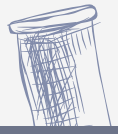
SeekRNA offers a powerful platform for addressing genetic disorders, cancer, infectious diseases, and autoimmune conditions, while advancing biomedical research and personalized therapeutic approaches.



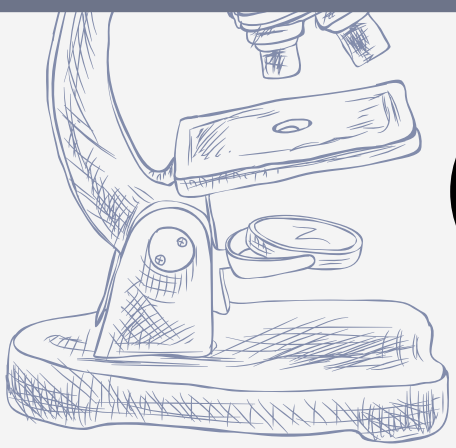
Parisa Nezafati

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

BIOTECHNOLOGY



The Introduction to Bioinformatics



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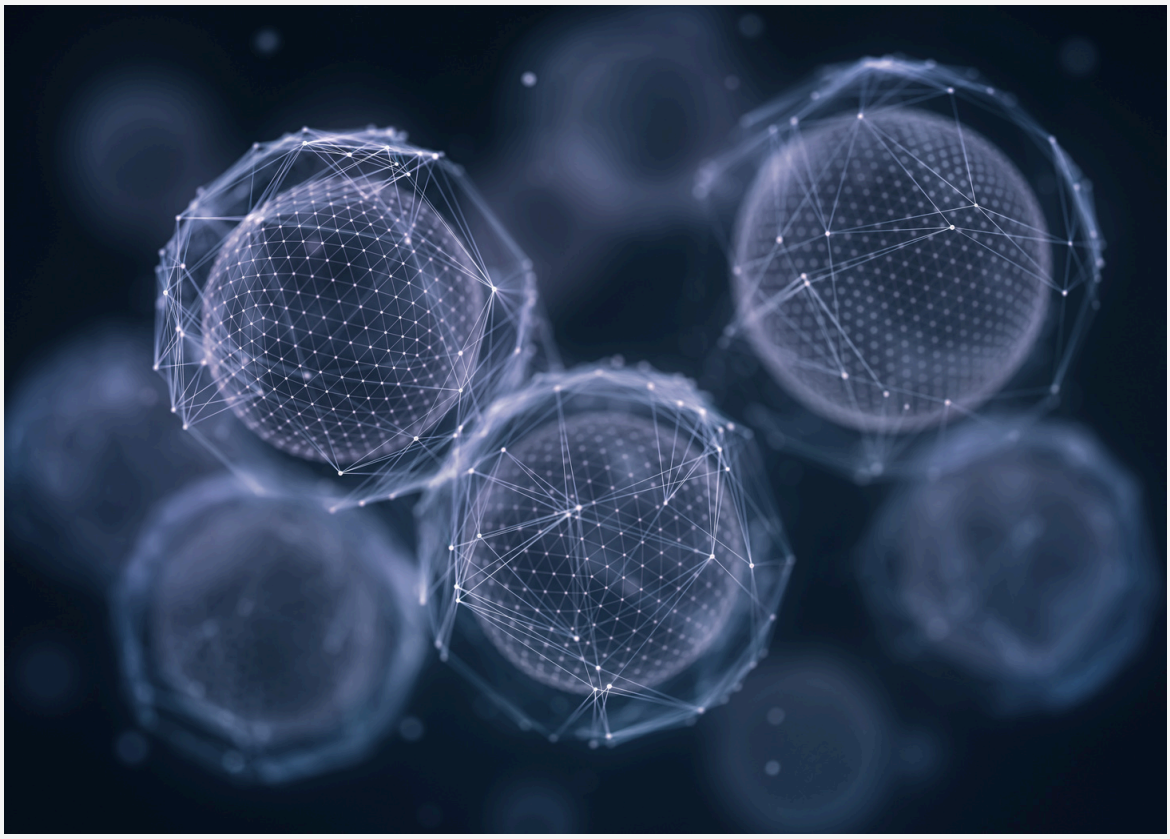
The Introduction to Bioinformatics

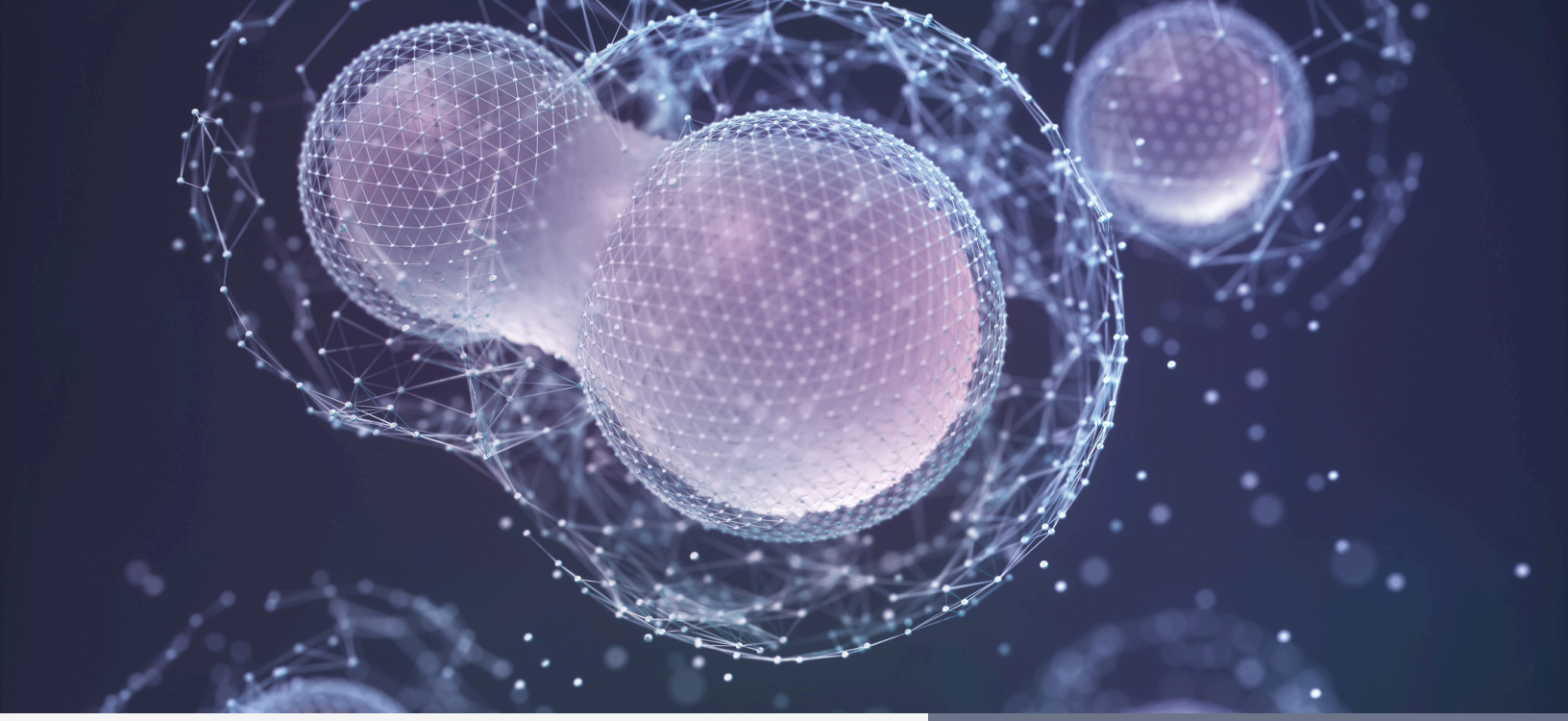


Introduction

Developed by Paulien Hogeweg and Ben Hesper in 1970, bioinformatics is a multidisciplinary approach and comes with many opportunities to submit and build new research and products to improve human welfare.

Important definitions of bioinformatics

- When biology, computer science, and information technology merge into a single discipline for managing and analyzing biological data using advanced computing techniques.
- The combination of biology and information technology.
- The stored data is available in the form of sequences and structures of proteins and nucleic acids.
- The science of collecting and analyzing complex biological data, such as genetic codes.
- It involves the computational tool and method used to manage, analyze, and manipulate volumes and volumes of biological data.



Application of Bioinformatics

- Sequence mapping of biomolecules (DNA, RNA, and proteins).
- Finding sites where restriction enzymes can cut
- Prediction of functional gene products
- Design a 3D Structure of the molecule
- Designing software
- Developing device drivers
- Embedded solution
- Biological data management
- Data and image analysis
- Drug discovery
- Genomics and proteomics

With the advancement of computational power, bioinformatics has taken up the possibility to handle huge amounts of data and incorporate a lot of information a lot quicker than it is delivered, turning into an answer that applies high-throughput methods in clinical diagnostics and customized medicine. For instance, a few examinations have shown that bioinformatics pipelines produced for the investigation of MALDI-ToF mass spectra can extract symptomatic data from pee, blood, and undeveloped organism culture media more quickly than their ability to be created

In genomics, a few bioinformatics pipelines for examination of NGS, RNAseq, and microarrays have been additionally developed to remove analytical data from sequencing of infections, infectious microorganisms, and malignant growth biopsies. Traditional lab work can be time-consuming and prone to human error. Bioinformatics is revolutionizing the field by streamlining workflows, automating data analysis, and enhancing diagnostic precision.

Challenges and the Path Forward

Data security, high computational costs, and the need for skilled professionals are significant hurdles. Additionally, ensuring standardized protocols across laboratories is crucial for maintaining accuracy and consistency in clinical decision-making.

Conclusion

The field of bioinformatics will continue to evolve through the incorporation of diverse technologies and methodologies that draw experts from disparate fields to create the latest computational and informational tools specifically designed for the biomedical research enterprise. As research continues to push boundaries, bioinformatics will remain at the forefront of innovation, shaping the future of healthcare.

Shiva Hafezi Ahmadi

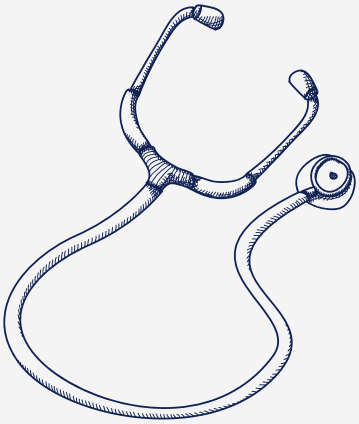
Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

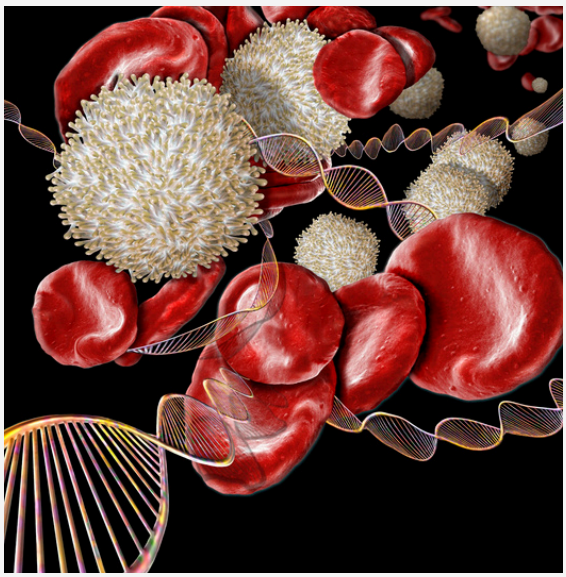
Hoda Rivandi

Department of anatomy, Rafsanjan university of medical studies, Rafsanjan, Iran

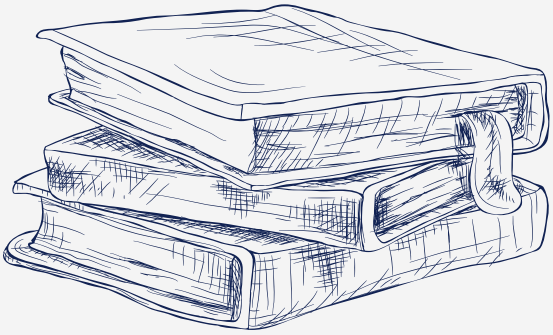
NEWS

TAKING ANTIBIOTICS DURING INFANCY MAY CAUSE TYPE 1 DIABETES





New Hemophilia Treatment Wins FDA Approval



TAKING ANTIBIOTICS DURING INFANCY MAY CAUSE TYPE 1 DIABETES

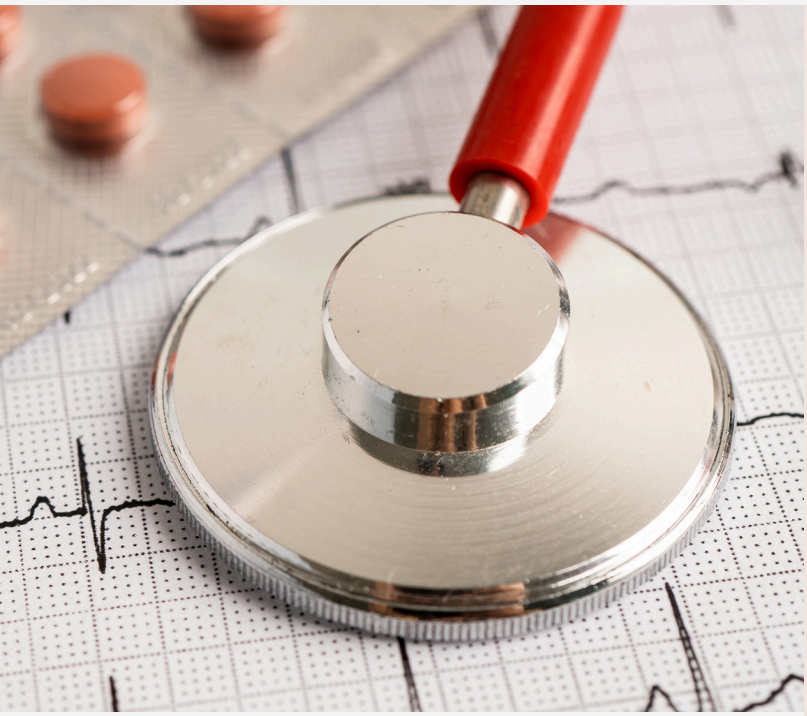
Antibiotic exposure during the critical early months of infancy may impair the development of insulin-producing pancreatic cells, potentially increasing the risk of diabetes later in life. Over two million Americans have type 1 diabetes—a condition in which the pancreas fails to produce insulin, leading to high blood sugar levels

While genetics plays a key role, environmental factors are also important. For example, although identical twins share the same genes, only one may develop the disease. Breastfeeding and vaginal birth help establish a healthy microbiome and may lower the risk of type 1 diabetes. Administering broad-spectrum antibiotics between 7 and 12 months of age has been shown to reduce pancreatic beta cells and raise blood sugar levels, highlighting the microbiome's long-term influence . In mouse studies, the fungus Candida dubliniensis increased beta cell counts. Similarly, fecal transplants from healthy infants aged 7–12 months promoted beta cell growth, unlike samples from other age groups. These findings suggest a future where microbiome-supporting supplements may be used alongside antibiotics to reduce long-term metabolic risks.

Mahsa Zarei

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

NEW HEMOPHILIA TREATMENT WINS FDA APPROVAL



March 31, 2025 - The Food and Drug Administration (FDA) approved a new drug as a preventive treatment to reduce bleeding episodes in individuals affected by specific types of hemophilia. Hemophilia is a rare blood coagulation disorder that occurs when the body lacks sufficient blood coagulation proteins or factors, which leads to prolonged bleeding following injury or surgery, and also spontaneous bleeding in muscles, joints, or organs.

This drug, which is sold under the name Qfitlia, acts by decreasing the amount of the antithrombin (AT) protein; this action helps to increase the amount of thrombin, which is an enzyme essential for blood coagulation. Qfitlia contains fitusiran, which uses RNA interference (RNAi) to block the production of AT. This drug is administered as a subcutaneous injection once every two months, and its dose and regimen are adjusted based on a specific FDA-approved test that monitors AT levels.

The most common side effects of Qfitlia are viral and bacterial infections and common cold symptoms. The FDA has added a warning for potential blood clotting and liver and gallbladder problems, so that some patients require gallbladder removal. They recommend performing liver function blood tests before and after starting Qfitlia, once a month for six months, and after increasing the dose.

Mobina Kashki

Department of Medical Laboratory Sciences. Varastegan Institute for Medical Sciences, Mashhad, Iran

GRATITUDE

Thank You

Behind every page of this journal lies more than just text and research—it carries the imprint of dedication, creativity, and a profound sense of responsibility.

We extend our sincere gratitude to Mobina Esfandi, whose exceptional talent and unwavering commitment brought the visual identity of this issue to life. Despite facing numerous personal and professional challenges, she demonstrated remarkable perseverance and artistic vision throughout the entire design process.

Her work went far beyond aesthetics; it created a harmonious bridge between science and design, enhancing the journal's impact and clarity through thoughtful visual expression. Every detail—from colors to layout—reflects her meticulous attention and heartfelt investment in this project.

Ms. Esfandi, we are truly grateful for your contributions. Your creativity, resilience, and professionalism have left a lasting mark on this publication.

We wholeheartedly wish you continued growth, fulfillment, and ever-greater success in all your future endeavors.

With respect and appreciation,
Infinity team

Thank You

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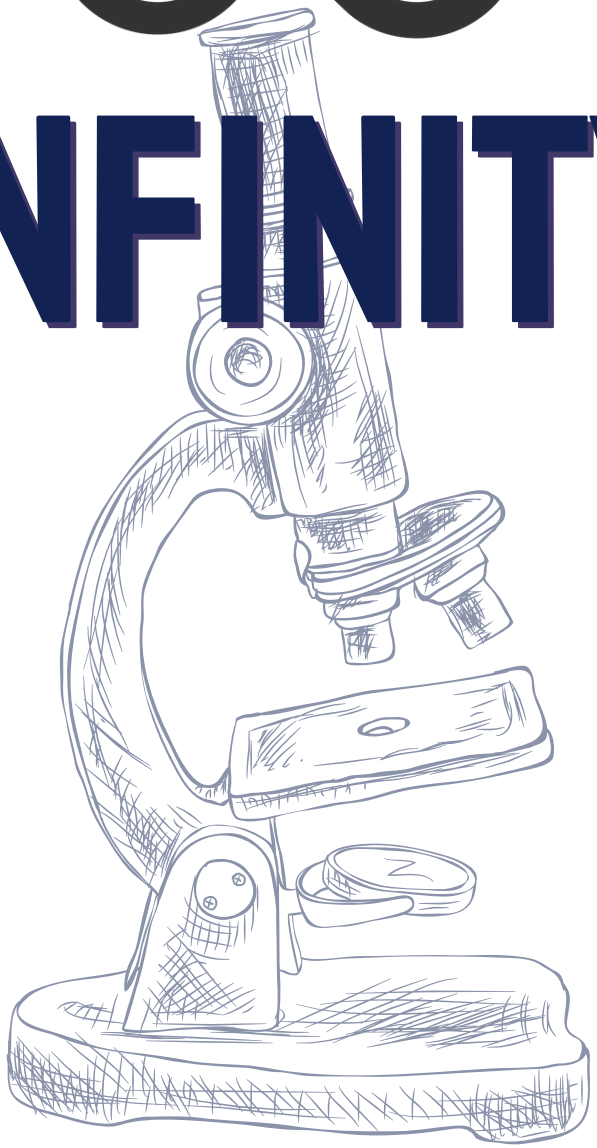

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