# INTERNATIONAL CONFERENCES
# MAY 2026

## ICBMS-X, ICNFEAS-X (Türkiye)
## ICCMM-VI (Italy)
## ICBM-X (UK)

# Conference Abstract Book

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**Organized and Supported by:**

# PREFACE

The INTERNATIONAL CONFERENCES — *10th International Conference on Biological and Medical Sciences (ICBMS-X)*, *10th International Conference on Food, Nutrition, Environmental and Agricultural Sciences (CNFEAS-X)* (Türkiye), *6th International Conference on Cellular and Molecular Medicine (ICCMM-VI)* (Italy), and the *10th International Conference on Biomedicine (ICBM-X)* (United Kingdom) — were scheduled for May 1–3, 2026. These conferences served as important platforms for scholarly exchange and discussions on recent advancements across a broad range of disciplines, including biological sciences, medical sciences, biomedicine, food and nutrition, environmental sciences, and agricultural sciences. The conferences provided a valuable opportunity for researchers and academics from Asia, Africa, and Europe to present, share, and discuss their latest research findings within their respective fields of expertise.

This Conference Abstract Book contains written versions of the majority of the contributions presented during the conferences, along with the refereed abstracts submitted for publication in this volume. All submitted abstracts underwent a rigorous blind peer-review process conducted by members of the Scientific Committee and Editorial Board. Acceptance for oral and poster presentations was based on originality, scientific relevance, contextual significance, and clarity, thereby ensuring the high quality of the published content.

Please note that this volume includes abstracts only. Both abstracts and full-text papers will subsequently be published in the *International Journal of BioLife Sciences (IJBLS)* (ISSN: 2821-1642), which will be available online with open accessibility to readers worldwide.

We sincerely thank all participants for their valuable contributions to the conference programs and to this Conference Abstract Book. We also extend our appreciation to the Conference and Session Chairs, as well as the Technical Support Team, for their dedicated assistance and continuous support.

We are honored to acknowledge the scientific support provided by Akdeniz University, Avicenna International College, Colombian Society for Biological Development, Bulgarian Society of Neurology, Argentina Society of Nutrition, International Scientific Association for Support and Development of Medical Technologies, and Fruit Growing Institute.

Finally, we wish all participants a productive, inspiring, and enjoyable conference experience, and we extend our best wishes for success in their technical presentations.

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***With the Best Regards,***
***Organizing Committee***
***May, 2026***

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# WELCOME MESSAGE

**Dr. Rahim AHMADI**

***AIC Member, Budapest, Hungary; IAS, AIREC and GREEN Scientific Committee Member***

***Dear Distinguished Colleagues, Precious Researchers,***

*As the Head of the Organizing Committee, it is my great pleasure and honor to warmly welcome all participants to the INTERNATIONAL CONFERENCES: 10th International Conference on Biological and Medical Sciences-X (ICBMS-X), 10th International Conference on Food, Nutrition, Environmental and Agricultural Sciences (ICNFEAS-X) (Türkiye), 6th International Conference on Cellular and Molecular Medicine-I (ICCMM-VI) (Italy), and the 10th International Conference on Biomedicine (ICBM-X) (United Kingdom), scheduled for May 1–3, 2026.*

*The conferences will explore a wide range of important and emerging topics in biological sciences, medicine, cellular and molecular medicine, biomedicine, food and nutrition sciences, environmental sciences, and agricultural sciences. We are confident that the scientific sessions and discussions will provide valuable insights and meaningful opportunities for academic exchange among participants from Asia, Africa, Europe, and beyond.*

*I sincerely hope that each participant will find topics closely aligned with their research interests and benefit from the rich scientific interactions and networking opportunities provided throughout the conferences. These events are designed to encourage the exchange of ideas, foster international collaboration, and strengthen connections among researchers, professors, scientists, and professionals from distinguished universities, research institutes, and international organizations worldwide.*

*Furthermore, it would be our greatest honor if these conferences inspire new scientific perspectives, innovative ideas, and future research collaborations within your respective fields of expertise.*

*Once again, I warmly welcome all participants and extend my best wishes for a productive, successful, and enjoyable conference experience.*

*Kind regards,*
***Dr. Rahim Ahmadi***
***Organizing Committee (Head)***
***May 1-3, 2026***

# WELCOME MESSAGE

**Prof. Dr. Bülent TOPCUOĞLU**

***Technical Sciences Vocational School, Akdeniz University, Antalya, Türkiye.***

***Dear Distinguished Delegates, Colleagues and Guests,***

*The The Organizing Committee warmly welcomes all distinguished delegates and guests to the ICBMS-X, ICNFEAS-X) (Türkiye), (ICCMM-VI) (Italy), and ICBM-X (UK), scheduled for May 1–3, 2026. These conferences are being organized with the collaborative efforts and scientific support of Akdeniz University, Avicenna International College, Colombian Society for Biological Development, Bulgarian Society of Neurology, Argentina Society of Nutrition, International Scientific Association for Support and Development of Medical Technologies, and Fruit Growing Institute.*

*These conferences have been organized to bring together members of the international scientific community and to provide researchers from around the world with an opportunity to present their cutting-edge research and innovative findings. The conferences have attracted and compiled technical research contributions covering a broad spectrum of disciplines, including biological sciences, medical sciences, cellular and molecular medicine, biomedicine, food and nutrition sciences, environmental sciences, and agricultural sciences.*

*All submitted papers and abstracts included in the conference proceedings underwent a rigorous peer-review process conducted by experts from the Scientific Committee, external reviewers, and members of the Editorial Board, according to the subject area of each submission. Following this comprehensive review process, contributions were selected based on their originality, scientific significance, relevance, and clarity, thereby ensuring the high academic quality of the conference proceedings.*

*The conference program is exceptionally rich and diverse, featuring high-impact presentations, scholarly discussions, and opportunities for interdisciplinary collaboration. These conferences will provide participants with a unique opportunity to explore the latest scientific developments in their respective fields of expertise while also gaining valuable insights into related disciplines.*

*We would like to express our sincere appreciation to the organizing staff, members of the program committees, reviewers, and technical support teams for their dedicated efforts and invaluable contributions toward the success of these conferences. We are also deeply grateful to all authors, presenters, participants, and collaborating institutions whose support and active involvement have made these events possible.*

*We sincerely hope that all participants and readers will benefit scientifically from the conference proceedings and find the experience intellectually stimulating, productive, and inspiring.*

*With our warmest regards,*
***Prof. Dr. Bülent TOPCUOĞLU***
***Conference Chair***
***May 1-3, 2026***

# WELCOME MESSAGE

Prof. Dr. Afrim TABAKU

*Aldent University, Tirana, Albania.*

***Dear colleagues,***

*As a IAS, GREEN and AIREC scientific committee chief member and conference chair, it is my great pleasure to warmly welcome you to the International Conferences: ICBMS-X, ICNFEAS-X, (Türkiye); ICCMM-VI (Italy), and ICBM-X (UK). These conferences aim to broaden up the scope with fresh insights towards recent findings in medical, biological, food and nutrition, environmental and agricultural sciences. The topics to be discussed include a variety of sciences including AI, life sciences, biology, biomedical sciences, health sciences, and medicine and pharmaceutical sciences as well as food, environmental and agricultural sciences.*

*By hosting this event we hope to enhance the scientific exchange and dialogue among young researchers as well as PhD and MSc students. We greatly appreciate your attendance and contribution to the success of the events.*

*With best wishes,*
***Prof. Dr. Afrim TABAKU,***
***Conference Chair***
***May 1-3, 2026***

# WELCOME MESSAGE

Dr. Mirela TABAKU

*Unversity of Medicine, Tirana, Albania.*

***Dear colleagues,***

*As a Scientific Committee Chief Member and Conference Chair representing International Association of Scientists (IAS), Global Research, Education and Event Network (GREEN), and Academy of International Research, Events, and Courses (AIREC), it is my great pleasure and honor to warmly welcome all participants to the International Conferences: ICBMS-X and ICNFEAS-X (Türkiye), ICCMM-VI ( Italy), and ICBM-X (UK).*

*These international conferences aim to expand scientific perspectives and promote the exchange of innovative ideas and recent discoveries in a wide range of disciplines, including medical sciences, biological sciences, biomedical sciences, artificial intelligence applications in healthcare and life sciences, pharmaceutical sciences, food and nutrition sciences, environmental sciences, and agricultural sciences. The conferences provide a multidisciplinary platform where researchers, academicians, healthcare professionals, scientists, and industry experts from around the world can share their latest research findings, experiences, and technological advancements.*

*Through these events, we aspire to strengthen international scientific collaboration and encourage meaningful academic dialogue among senior researchers, early-career scientists, postdoctoral fellows, and MSc and PhD students. We believe that scientific progress flourishes through communication, cooperation, and the open exchange of knowledge across disciplines and borders.*

*The conference program has been designed to include high-quality keynote lectures, oral and poster presentations, and interactive scientific discussions covering both emerging trends and current challenges in the related fields. We are confident that participants will benefit from the rich academic environment, networking opportunities, and interdisciplinary interactions provided throughout the conferences.*

*We deeply appreciate your participation, valuable contributions, and continuous support, all of which play a vital role in the success of these conferences. Your presence and scientific engagement make these events a truly meaningful international gathering.*

*We sincerely hope that the conferences will provide an inspiring and productive experience for all attendees and will lead to new collaborations, innovative ideas, and future scientific achievements.*

*With best regards and warm wishes for a successful conference experience.*

*With kind regards,*
***Dr. Mirela TABAKU,***
***Conference Chair***
***May 1-3, 2026***

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## Scientific Committee

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**Dr. B. Thi Dung**, Institute of Ecology and Biological Resources and Graduate University of Science and Technology, Vietnam Academy of Science and Technology; External lecturer at University of Paris-Saclay, France.
**Dr. N. Rabienezhad Ganji**, Dipartimento di Biomedicina, Neuroscienze e Diagnostica Avanzata, Università degli Studi di Palermo, 90133 Palermo, Italy.

Keynote Speech


KEYNOTE
SPEECH


**PROF. DR. BÜLENT TOPCUOĞLU**
Akdeniz University
**Türkiye**

**TITLE:**

**Effects of foliar and soil-applied cobalt combined with humic acid on growth and Cobalt biofortification of pepper (Capsicum annuum L.)**

**10:35 AM – 10:55 AM**
**Türkiye Time**

Organized by:
AKDENIZ UNIUVERSITY, GREEN, IAS, AIREC

Keynote Speech

# CONFERENCE PROGRAM

## KEYNOTE SPEECH

LIVE

**DR. MIRELA TABAKU**
Conference Chair, Tirana Medical University
**ALBANIA**

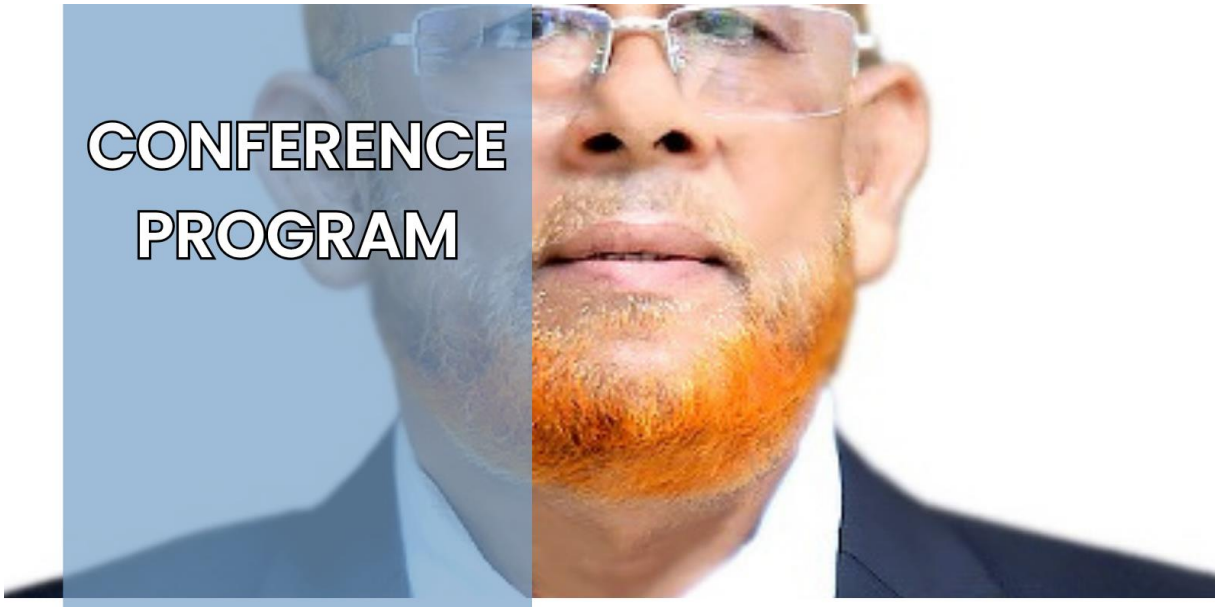
**TITLE:**

**Paclitaxel Angiogenesis Potential in Breast Cancer**

**10:55 AM – 11:15 AM**
**Türkiye Time**

Organized by:
AKDENIZ UNIUVERSITY, GREEN, IAS, AIREC

Special Talk



# CONFERENCE PROGRAM

LIVE

## KEYNOTE SPEECH

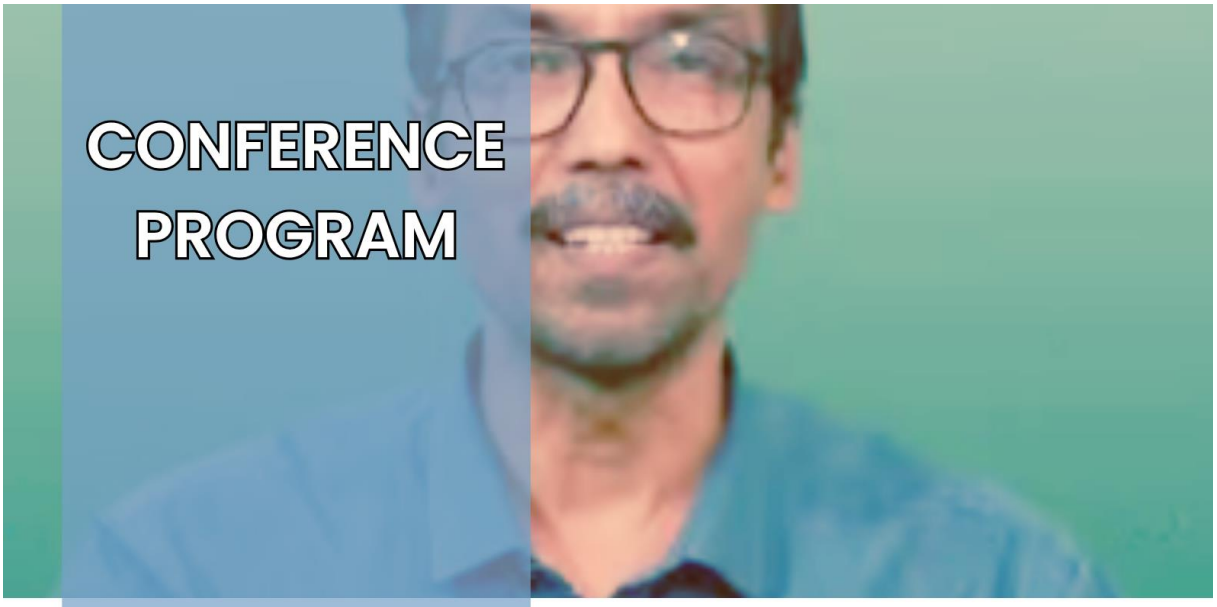
**PROF. DR. MD. AMINUR RAHMAN**
Department of Fisheries and Marine Bioscience,
Faculty of Biological Science and Technology,
Jashore University of Science and Technology,
Jashore, Bangladesh

**TITLE:**
**Unveiling the Mysterious Darkness: Unlocking Marine Biotechnology for Blue Growth and Biodiversity Hotspots in the Indo-Pacific Ocean Ecosystem**

**12:10 PM - 12:30 PM**
**Türkiye Time**

Organized by:
AKDENIZ UNIUVERSITY, GREEN, IAS, AIREC

Special Talk




# CLOSING KEYNOTE SPEECH


**PROF. DR. AMITAVA RAKSHIT**
Department of Soil Science and Agricultural Chemistry at the Institute of Agricultural Sciences, Banaras Hindu University (BHU), **India**

**TITLE:**
**Roots at the Frontier:**
**Soil Health Reimagined**

**16:30 - 16:50**
**Türkiye Time**

Organized by:
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ABSTARCTS

# Diagnostic Significance of CD34, HLA-DR and CD11b, Expression in Acute Promyelocytic Leukemia: A Single-Center Study from Albania's Sole Flow Cytometry Reference Laboratory

**Valentina Semanaj*[1], Teuta Dedej[1], Alma Barbullushi[1], Elona Lamaj[1], Majlinda Kokici[1], Teuta Curaj[1], Adela Perolla[2], Elsuarta Calliku[2], Alma Cili[2], Irena Korita[1], Polikron Pulluqi[2], Arben Ivanaj[2]**

[1]Laboratory Networks, University Hospital Center "Mother Teresa" Tirana, Albania.

[2]Department of Internal Medicine, Service of Hematology, University Hospital Center "Mother Teresa", Tirana, Albania.

**Background and Aim:** Acute Promyelocytic Leukemia (APL) is a distinct subtype of acute myeloid leukemia that requires rapid diagnosis due to the risk of severe coagulopathy. Multiparametric flow cytometry plays a key role in its early identification. This study aimed to evaluate the diagnostic significance of CD34, HLA-DR, and CD11b expression in APL cases diagnosed at Albania's only national reference center for flow cytometric immunophenotyping.

**Method:** A retrospective study included 37 patients diagnosed with APL between 2020 and 2025. Bone marrow samples were analyzed using a 6-color DxFLEX flow cytometer. Multiparametric flow cytometry was performed with a panel of myeloid, progenitor, granulocytic, monocytic, aberrant, and lymphoid markers. CD45 expression and forward/side scatter were used for leukemic cell gating. Descriptive statistical analysis was applied to demographic, morphological, and immunophenotypic variables.

**Results:** The mean age of patients was 49.5 ± 14.2 years (range 1–75), including 19 males (51%) and 18 females (49%). The mean percentage of pathological promyelocytes/blasts was 78%, indicating significant leukemic infiltration at diagnosis. All cases expressed CD13 and CD33 (100%), while CD117 was positive in 97% of patients, confirming myeloid lineage. CD34 was detected in 8% of cases and HLA-DR was negative, consistent with the classical $CD34^{-}$/$HLA\text{-}DR^{-}$ APL immunophenotype. CD11b expression was observed in only one case (2.7%). Morphologically, the hypergranular subtype predominated (94.6%), while the hypogranular variant accounted for 5.4% of cases.

**Conclusion:** MFC is a rapid and reliable method for identifying APL. The characteristic triplenegative immunophenotype ($CD34^{-}$/HLA-$DR^{-}$/$CD11b^{-}$) enables early recognition. This study provides the first national immunophenotypic data on APL in Albania and highlights the importance of integrated diagnostic approaches.
**Keywords**: *Acute promyelocytic leukemia, Immunophenotyping, Flow cytometry*

***Corresponding author:** Valentina Semanaj, Laboratory Networks, University Hospital Center "Mother Teresa" Tirana, Albania.

# Review of Plant Extracts for Treating Male Infertility: Key Findings on Sperm Health

**Rezvaneh Jahangiri*[1], Rezarta Shkreli[2]**

[1] Department of Biology, Hamedan Branch, Islamic Azad University, Hamedan, Iran.

[2] Department of Pharmacy, ALDENT University, Tirana, Albania.

**Background and Aim:** Male infertility is a significant global health concern, often linked to poor sperm health. The therapeutic potential of plant extracts, with their rich phytochemical profiles, is increasingly being explored. This review aims to systematically synthesize and evaluate the current evidence on the efficacy of plant extracts in improving sperm parameters.

**Method:** A systematic search was conducted across PubMed, Scopus, and Web of Science databases. Keywords included "plant extract," "phytotherapy," "male infertility," "sperm count," "sperm motility," and "sperm morphology." Eligible studies were in-vitro, in-vivo, or clinical trials published in English, specifically investigating the effects of defined plant extracts on measurable sperm health outcomes.

**Results:** The analysis of numerous studies indicates that various plant extracts (e.g., from *Withania somnifera*, *Mucuna pruriens*, *Panax ginseng*) significantly improve key sperm parameters. The most consistent findings were enhanced sperm motility and concentration. These benefits are largely attributed to the antioxidant, anti-inflammatory, and hormone-modulating properties of bioactive compounds like flavonoids and alkaloids, which mitigate oxidative stress—a primary cause of sperm damage.

**Conclusion:** Plant extracts represent a promising, natural, and complementary approach for managing male infertility by effectively improving sperm health. Further rigorous, large-scale human clinical trials are warranted to standardize dosages and confirm therapeutic efficacy.

**Keywords:** *Male Infertility, Plant extracts, Phytotherapy, Sperm motility, Sperm count, Antioxidant*

***Corresponding author:** Rezvaneh Jahangiri, Department of Biology, Hamedan Branch, Islamic Azad University, Hamedan, Iran.

# Engineering the Future of Cancer Care: A Review of Nanoparticle-Based Precision Therapeutics

**Atefeh Hasanli***

Department of Nanobiotechnology, Faculty of Biological Science,
Tarbiat Modares University, Tehran, Iran

**Background and Aim:** Cancer remains a leading cause of mortality, underscoring the need for advanced therapeutic strategies that minimize off-target effects. This review aims to synthesize current evidence on the application of engineered nanoparticles for precision cancer therapy, focusing on their design, targeting mechanisms, and therapeutic efficacy.
**Method:** Systematic literature search was conducted using databases such as PubMed, Scopus, Google Scholar and Web of Science databases. Keywords included "nanoparticles," "cancer therapy," "targeted drug delivery," "precision medicine," and "nanotherapeutics." *In vitro*, *in vivo*, or clinical data on nanoparticle-based cancer treatments were included.
**Results:** The analysis of selected studies demonstrates that nanoparticle-based systems significantly enhance drug bioavailability, enable specific tumor targeting through ligands and stimuli-responsive mechanisms, and reduce systemic toxicity. Key advancements include improved outcomes in drug-resistant cancers and theranostic applications combining therapy and diagnostics.
**Conclusion:** Nanoparticle-based platforms represent a transformative approach in oncology, offering highly precise and efficient therapeutic modalities. Future efforts should focus on clinical translation, scalability, and long-term safety profiles to fully integrate these innovations into mainstream cancer care.
**Keywords*:*** *Nanoparticles, Precision Medicine, Targeted Drug Delivery, Cancer Therapeutics, Nanomedicine.*

***Corresponding author:** Atefeh Hasanli, Department of Nanobiotechnology, Faculty of Biological Science, Tarbiat Modares University, Tehran, Iran.

# Comparative Cytotoxicity of Methanolic and Ethyl Acetate Extracts of Rosa canina Fruit on Human Gastric Adenocarcinoma Cells

**Latifeh Sarabi Aghbolagh[1]*, Adela Perolla[2], Ghazal Alam Khan[3]**

[1] Department of Cell and Molecular Biology, Faculty of Basic Sciences, University of Mohaghegh Ardabili, Ardabil, Iran
[2] Department of Internal Medicine, University of Medicine, Tirana, Albania
[3] Department of Clinical Nutrition, King Faisal University, KSA

**Background and Aim:** Gastric cancer remains a significant global health challenge, necessitating the exploration of novel therapeutic agents from natural sources. Rosa canina fruit has been traditionally recognized for its medicinal properties, though its specific anticancer potential, particularly against gastric carcinoma, warrants further investigation. This study aimed to comparatively assess the cytotoxic effects of methanolic and ethyl acetate extracts of Rosa canina fruit on AGS human gastric adenocarcinoma cells.
**Method:** AGS cells were treated with concentrations ranging from 20 to 110 µg/mL of each extract for 24 hours. Cytotoxicity was evaluated using the MTT assay, and statistical significance was determined via one-way ANOVA.
**Results**: Both extracts induced concentration-dependent reductions in cell viability. The methanolic extract exhibited an IC50 of 82.61 µg/mL, reducing viability to 29.60% at 110 µg/mL. The ethyl acetate extract demonstrated greater potency, with an IC50 of 74.58 µg/mL and viability declining to 28.26% at the highest concentration. All results were statistically significant ($p < 0.05$). These outcomes suggest that solvent polarity significantly influences the extraction efficiency of cytotoxic compounds, with ethyl acetate potentially enriching more potent anticancer constituents.
**Conclusion:** The ethyl acetate extract of Rosa canina fruit shows higher cytotoxic efficacy against AGS cells compared to the methanolic extract, highlighting solvent selection as a critical factor in optimizing bioactive compound extraction for anticancer applications. These findings emphasize the value of Rosa canina as a promising natural resource in developing complementary therapeutic strategies for gastric cancer.
**Keywords***: Rosa canina, Methanolic extract, Ethyl acetate extracts Cytotoxic activity*

***Corresponding author:** Latifeh Sarabi Aghbolagh, Department of Cell and Molecular Biology, Faculty of Basic Sciences, University of Mohaghegh Ardabili, Ardabil, Iran.

# Artificial Intelligence in Medical and Paramedical Laboratory Education: A Comprehensive Review

**Büsra Günay***
Department of Biology, Ege University, Izmir, Türkiye

**Background and Aim:** The integration of artificial intelligence (AI) into healthcare is rapidly transforming diagnostic and analytical practices. This evolution necessitates a parallel shift in medical and paramedical laboratory education to prepare future professionals. This comprehensive review aims to synthesize and critically evaluate the existing literature on the application, effectiveness, and potential of AI tools in enhancing laboratory science education.
**Method:** A systematic literature search was conducted using major academic databases (PubMed, Scopus, Web of Science, and IEEE Xplore). Keywords included combinations of "artificial intelligence," "machine learning," "education," "medical laboratory," "biomedical science," and "paramedical." Inclusion criteria focused on peer-reviewed articles, conference proceedings, and reviews published in English between 2020-2026 that specifically addressed AI applications in didactic or practical lab education. AI-assisted tools, including Python for data analysis and platforms like NotebookLM for literature synthesis, were employed to manage, analyze, and visualize the extracted data and identify key thematic trends.
**Results**: The analysis revealed several prominent applications, including AI-powered virtual simulations for practical skill development, adaptive learning platforms for personalized content delivery, and intelligent tutoring systems. These tools demonstrated potential in improving student engagement, knowledge retention, and competency in complex diagnostic reasoning.
**Conclusion:** AI presents a transformative opportunity for medical and paramedical laboratory education by offering scalable, personalized, and immersive learning experiences. Successful implementation requires thoughtful integration into curricula and addressing challenges related to access and algorithmic bias. AI is poised to be an indispensable component in training the next generation of laboratory professionals.
**Keywords***: Artificial intelligence, hHealthcare education, Laboratory science, Adaptive learning, Virtual simulation*

***Corresponding author:** Büsra Günay, Department of Biology, Ege University, Izmir, Türkiye.

# The Vagus Nerve at the Interface of the Microbiota-Gut-Brain Axis: Impact of Antistress Tea

**Gheorghe Giurgiu[1], Manole Cojocaru[2,3]**

[1]Deniplant-Aide Sante Medical Center, Biomedicine, Bucharest, Romania.
[2]Academy of Romanian Scientists.
[3]Titu Maiorescu University, Faculty of Medicine, Bucharest, Romania.

**Background and Aim:** Studies have demonstrated that gut health and the composition of gut microbiota significantly influence mental well-being through the microbiota-gut-brain axis, particularly via vagus nerve signaling. The gut microbiome performs essential physiological functions including digestion of polysaccharides, biosynthesis of vitamins and nutrients, colonization resistance, and immune modulation. This study aimed to evaluate the impact of Antistress tea on gut microbiota balance, inflammation, and anxiety-related mechanisms associated with the gut-brain axis.
**Method:** A comprehensive evaluation of Antistress tea was conducted alongside a review of current evidence regarding the reciprocal interactions between diet, anxiety, gut microbiota, and inflammation. The study examined how food additives and dietary components alter the functional profiles of the gut microbiome and explored interventions capable of modulating microbiota composition and anxiety-related responses through gut-brain axis mechanisms.
**Results:** The human gut microbiome can be easily disturbed by exposure to various additives, with gut bacteria playing a major role in additive biotransformation. Food additives may contribute to worsening intestinal inflammation and functional perturbations in the microbiome. Environmentally induced dysbiosis has been strongly associated with increased risks of inflammatory bowel disease, obesity, diabetes, cardiovascular disease, liver disease, colorectal cancer, and neurological disorders. Dietary interventions, including the use of Antistress tea, may help support microbiota balance and reduce anxiety-related symptoms by influencing gut-brain communication pathways mediated through the vagus nerve.
**Conclusion:** The gut microbiome has become a major focus of biomedical research due to its critical role in human health and disease. Functional disturbances caused by dietary additives may contribute to both gastrointestinal and neuropsychiatric disorders. Healthier dietary strategies and microbiota-modulating interventions such as Antistress tea may provide beneficial effects in reducing anxiety and supporting gut-brain axis homeostasis.
**Keywords:** *Gut microbiome, Additives, Anxiety, Antistress tea, Vagus nerve, Gut-brain axis.*

***Corresponding author:** Gheorghe Giurgiu, Deniplant-Aide Sante Medical Center, Biomedicine, Bucharest, Romania.

# The Gut Microbiome as an Emerging Biomarker in the Early Diagnosis of Neurodegenerative Diseases

**Maria Ciubotaru*[1], Alin Stelian Ciobica[2,3]**

[1] Faculty of Biology, "Alexandru Ioan Cuza" University of Iasi, Romania.

[2] "Ioan Haulica" Institute, "Apollonia" University, Iasi, Romania.

[3] "Alexandru Ioan Cuza" University of Iasi, Romania.

**Background and Aim:** Neurodegenerative diseases (NDs), including Alzheimer's disease (AD), Parkinson's disease (PD), dementia with Lewy bodies (DLB), amyotrophic lateral sclerosis (ALS), and Huntington's disease (HD), represent a major and increasing global health burden associated with population aging and the limited availability of effective disease-modifying therapies. Early diagnosis remains challenging due to the absence of reliable biomarkers capable of identifying disease during preclinical or prodromal stages. This review explores the emerging role of the gut microbiome as a potential non-invasive biomarker in the early detection and differential diagnosis of neurodegenerative diseases.

**Method:** A comprehensive review of clinical, epidemiological, and experimental studies was conducted to evaluate current evidence regarding gut microbiome alterations in major neurodegenerative disorders. Human cohort studies and animal models investigating microbiota dysbiosis, microbiota-gut-brain axis mechanisms, and microbiome-derived diagnostic signatures were analyzed. Mechanistic pathways involving neuronal, immunological, endocrine, and metabolic signaling interactions were also assessed.

**Results:** Increasing evidence indicates that gut microbiome dysbiosis may precede overt neurological manifestations and contribute to neurodegenerative progression through the microbiota-gut-brain axis. Alterations in intestinal microbial composition have been associated with neuroinflammation, blood-brain barrier dysfunction, microglial activation, and abnormal protein aggregation within the central nervous system. Distinct microbial signatures have been identified across several neurodegenerative diseases, suggesting their potential utility as non-invasive biomarkers for early diagnosis and disease differentiation. Experimental findings further support the role of gut microbiota in modulating disease onset and progression through immune and metabolic pathways.

**Conclusion:** The gut microbiome represents a promising emerging biomarker for the early diagnosis of neurodegenerative diseases. Advances in microbiome profiling and mechanistic understanding of the microbiota-gut-brain axis may facilitate the development of innovative diagnostic and therapeutic strategies. However, additional large-scale, standardized, and longitudinal studies are required to overcome current methodological limitations and support clinical translation.

**Keywords:** *Gut microbiome, Neurodegenerative diseases, Biomarkers, Microbiota-gut-brain axis, Alzheimer's disease, Parkinson's disease, Dysbiosis*.

***Corresponding author:** Maria Ciubotaru, Faculty of Biology, "Alexandru Ioan Cuza" University of Iasi, Romania.

# Exploring *Heliotropium Europaeum* as a Natural Hemostatic and Wound Healing Agent: *In Vivo* Evidence

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**Background and Aim:** Uncontrolled bleeding and impaired wound healing remain major clinical challenges, particularly in trauma care and chronic wound management, contributing to increased morbidity and healthcare burden. The search for safe, effective, and affordable plant-derived therapeutics has intensified in recent years. Heliotropium europaeum, traditionally recognized for its hemostatic and wound healing properties, was investigated in this study to evaluate its therapeutic potential using validated in vivo experimental models.

**Method:** Hemostatic activity was evaluated by measuring bleeding time following standardized wound induction in rats. Wound healing efficacy was assessed using a full-thickness excision wound model involving four experimental groups: untreated control, daily topical application of H. europaeum leaf powder, intermittent application every six days, and a reference treatment containing 10% Mimosa tenuiflora extract. Macroscopic wound healing progression was monitored throughout the experimental period, while histological analyses of regenerated tissues were performed to assess tissue repair. Statistical significance was considered at $p<0.05$.

**Results:** Heliotropium europaeum significantly reduced bleeding time, demonstrating rapid hemostatic activity. Daily topical application accelerated wound contraction and achieved complete wound closure within 12 days compared to untreated controls. Histopathological evaluation revealed enhanced reepithelialization, organized collagen fiber deposition, improved tissue remodeling, and reduced inflammatory cell infiltration in treated groups. The observed regenerative effects were comparable to or exceeded those of the reference treatment.

**Conclusion:** The present findings provide strong experimental evidence supporting the traditional medicinal use of Heliotropium europaeum as a natural hemostatic and wound healing agent. Its dual haemostatic and pro-healing activities highlight its potential as a promising plant-based therapeutic candidate for acute wound management and postsurgical care. Further investigations focusing on the identification of active bioactive compounds and clinical validation are warranted.

**Keywords:** *Heliotropium europaeum, Haemostasis, Wound healing, Tissue regeneration, Translational medicine, Plant-based therapeutics.*

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# Exosomal MicroRNA Reprogramming in Alzheimer Diseases: A Revolutionary Era in Closed-Loop Amyloid-β Clearance System

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**Background and Aim:** Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by the abnormal accumulation of amyloid-β peptides, particularly the aggregation-prone amyloid-β42 (Aβ42) isoform, which contributes to neuronal toxicity and synaptic dysfunction. Current therapeutic strategies have shown limited success in achieving sustained amyloid clearance from the central nervous system (CNS). This study proposes a novel conceptual framework utilizing engineered exosomes and exosomal microRNA reprogramming as an innovative closed-loop therapeutic system for targeted amyloid-β clearance and molecular modulation in AD.

**Method:** A theoretical and integrative biological platform was designed using engineered exosomes derived from patient-specific cells as biocompatible nanocarriers. These exosomes were conceptualized to selectively recognize and bind Aβ42 oligomers with high specificity. Following target engagement, the engineered system facilitates enzymatic degradation of amyloid aggregates and subsequent transport of the resulting cargo from the CNS into systemic circulation. Additionally, an extracorporeal microfiltration mechanism was proposed for selective peripheral removal of exosome-associated amyloid cargo. The framework further incorporates exosomal microRNA (exo-miRNA) engineering aimed at modulating dysregulated neuronal and glial molecular pathways involved in excessive amyloid production and impaired physiological clearance.

**Results:** The proposed platform hypothetically establishes a self-sustaining therapeutic circuit through coordinated mechanisms involving Aβ42 recognition, catalytic degradation, peripheral elimination, and miRNA-mediated molecular reprogramming. Engineered exosomes may provide targeted and biologically adaptive delivery systems capable of reducing amyloid burden while simultaneously restoring disrupted cellular signaling pathways associated with AD progression. The integration of extracorporeal filtration may further prevent amyloid re-entry into the brain and support continuous detoxification of the CNS environment.

**Conclusion:** Engineered exosomal microRNA reprogramming represents a promising and revolutionary approach in Alzheimer's disease therapeutics. By combining targeted amyloid clearance with molecular pathway modulation, this conceptual closed-loop system may offer a multifaceted strategy for restoring amyloid homeostasis and potentially slowing or halting disease progression. Further experimental and clinical investigations are necessary to validate the feasibility, safety, and therapeutic efficacy of this innovative platform.

**Keywords:** *Alzheimer disease, Amyloid-β, Engineered exosomes, MicroRNA, Molecular medicine.*

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# Decoding Hypoxia-Induced Metabolic Rewiring: Shaping Tumor–Immune Crosstalk and Implications for Precision Cancer Immunotherapy

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**Background and Aim:** Hypoxia is a defining characteristic of the tumor microenvironment (TME) that promotes extensive metabolic and immunological reprogramming, thereby influencing cancer progression, immune evasion, and therapeutic resistance. Central to this adaptive process is hypoxia-inducible factor-1α (HIF-1α), which drives metabolic alterations toward aerobic glycolysis and contributes to the establishment of an immunosuppressive microenvironment. This review aims to explore the interconnected mechanisms through which hypoxia-induced metabolic rewiring shapes tumor–immune crosstalk and to highlight its implications for precision cancer immunotherapy.

**Method:** A comprehensive review of current literature was conducted focusing on hypoxia-mediated metabolic pathways, lactate signaling, pH regulation, extracellular vesicle biology, and immune modulation within the TME. Key molecular mediators including HIF-1α, glycolytic enzymes, carbonic anhydrases, immune checkpoint molecules, and exosome-associated factors were analyzed to evaluate their contribution to tumor progression and immune resistance.

**Results:** Hypoxia-induced activation of HIF-1α enhances the expression and activity of critical glycolytic enzymes such as hexokinase, pyruvate kinase M2 (PKM2), and lactate dehydrogenase A (LDHA), resulting in increased glucose uptake and lactate accumulation. Concurrent upregulation of carbonic anhydrases, particularly CAIX, contributes to extracellular acidification and maintenance of intracellular pH homeostasis, generating a tumor-permissive environment. Elevated lactate levels suppress cytotoxic T lymphocyte and natural killer (NK) cell activity while promoting regulatory T-cell differentiation and M2-like tumor-associated macrophage polarization, collectively reinforcing immune suppression. Hypoxia further increases PD-L1 expression through HIF-1α-dependent pathways, reducing the efficacy of immune checkpoint blockade therapies. Additionally, hypoxia influences the release of extracellular vesicles and exosomes enriched with metabolites, enzymes, and regulatory RNAs that propagate immunosuppressive and pro-tumorigenic signaling throughout the TME.

**Conclusion:** Hypoxia-induced metabolic reprogramming plays a central role in shaping tumor–immune interactions and promoting therapeutic resistance in cancer. Targeting metabolic enzymes, lactate signaling pathways, pH regulators such as carbonic anhydrases, and hypoxia-associated immune mechanisms may provide innovative strategies to restore anti-tumor immunity. Integrating these approaches with immune checkpoint inhibition offers significant potential for advancing precision cancer immunotherapy and improving clinical outcomes in cancer patients.

**Keywords:** *Cancer, Hypoxia, Immunotherapy, Metabolic reprogramming, Tumor microenvironment, Precision medicine.*

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# The Synergy of Artificial Intelligence and Computational Chemistry in Modern Drug Discovery (2021–2026): A Systematic Review

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**Background and Aim:** Artificial intelligence (AI) has rapidly transformed modern drug discovery by improving the speed, efficiency, and accuracy of identifying, optimizing, and validating therapeutic candidates. Recent advances in deep learning, graph-based modeling, molecular simulations, and generative algorithms have enabled improved characterization of complex biochemical interactions and accelerated the design of novel compounds with enhanced therapeutic potential. This systematic review aimed to evaluate the integration of AI with computational chemistry approaches and assess its impact on predictive performance, generalizability, and translational applicability across drug discovery pipelines.

**Method:** A systematic review and comparative meta-analytical synthesis were conducted using studies published between 2021 and 2026. Electronic databases including PubMed, Scopus, OpenAlex, and ChemRxiv were searched for eligible studies integrating AI with computational chemistry techniques such as molecular docking, molecular dynamics simulations, and free energy calculations. Included studies evaluated AI applications in drug–target interaction prediction, virtual screening, binding affinity estimation, and de novo molecular design. Due to methodological heterogeneity among studies, a structured comparative analysis of performance metrics including ROC-AUC, RMSE, AUPRC, and enrichment factors was performed.

**Results:** AI-based computational approaches demonstrated superior performance compared with traditional computational methods in approximately 85% of evaluated studies. Significant improvements were observed particularly in classification models and drug–target interaction prediction tasks, where ROC-AUC values frequently exceeded 0.90. Hybrid models combining AI methodologies with physics-based simulations showed enhanced predictive accuracy, robustness, and biological relevance. Nevertheless, substantial variability in dataset quality, validation strategies, reporting standards, and experimental reproducibility contributed to heterogeneity across study outcomes. Despite these limitations, the findings indicate a growing dominance of hybrid, physics-informed AI frameworks in modern computational drug discovery.

**Conclusion:** The integration of artificial intelligence with computational chemistry represents a transformative advancement in drug discovery and precision medicine. Hybrid AI-driven approaches demonstrate significant potential to improve predictive modeling, accelerate therapeutic development, and optimize drug design processes. However, standardized benchmarking protocols, rigorous validation frameworks, and expanded experimental verification remain essential to facilitate the reliable clinical translation of AI-based drug discovery technologies.

**Keywords:** *Artificial intelligence, Drug discovery, Computational chemistry, Systematic review.*

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# Sex Differences in Pain Threshold: A Review of Animal Models

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**Background and Aim:** Pain perception exhibits significant sex differences, with clinical and preclinical studies consistently reporting a higher prevalence and severity of chronic pain in females. Understanding the biological mechanisms underlying these disparities is crucial for developing targeted analgesic therapies. This review aims to synthesize and critically evaluate the existing evidence from animal models on sex differences in basal pain thresholds.
**Method:** A systematic literature search was conducted using PubMed, Scopus, and Web of Science databases. Keywords included combinations of "sex difference," "gender difference," "pain threshold," "nociception," "rodent," "mouse," and "rat." Studies were included if they were original research articles directly comparing pain thresholds between male and female rodents under baseline conditions, using standard assays (e.g., hot plate, tail flick, von Frey filaments).
**Results:** The majority of reviewed studies demonstrate a clear pattern: female rodents of various strains consistently exhibit different pain thresholds compared to males across multiple modalities, including thermal, mechanical, and chemical stimuli. This difference in pain threshold between females and males is influenced by gonadal hormones, which modulate sensitivity to pain stimulants.
**Conclusion:** Animal model research robustly confirms the existence of fundamental sex differences in pain processing between males and females. These findings underscore the critical importance of including both sexes in pain research. The mediating role of gonadal hormones highlights a key biological mechanism, suggesting that optimal pain management may require sex-specific approaches that account for hormonal status.
**Keywords:** *Sex differences, Pain threshold, Animal models, Gonadal hormones.*

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ABSTARCTS

# Review of Plant Extracts for Treating Female Infertility: Focus on Ovulation and Hormonal Balance

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**Background and Aim:** Female infertility, often linked to ovulatory dysfunction and hormonal imbalance, has spurred interest in complementary treatments. This review aims to systematically evaluate the efficacy of plant extracts in improving ovulation and restoring hormonal balance in cases of female infertility.
**Method:** A comprehensive literature search was conducted using PubMed, Scopus, Web of Science, and Google Scholar. Keywords included "female infertility," "plant extract," "medicinal plants," "ovulation," "hormonal balance," "phytoestrogens," and "polycystic ovary syndrome (PCOS)." Eligible studies were original research articles (in vitro, in vivo, and clinical trials) published in English, focusing on plant-based interventions for ovulatory disorders and endocrine-related infertility.
**Results:** The analysis identified several plant extracts, such as Vitex agnus-castus, Cimicifuga racemosa, and Trigonella foenum-graecum, demonstrating promising effects on luteinizing hormone (LH), follicle-stimulating hormone (FSH), estrogen, and progesterone levels. These extracts appear to modulate hormonal pathways, enhance folliculogenesis, and improve ovulation rates, particularly in PCOS models.
**Conclusion:** Plant extracts offer a potential complementary approach for managing hormonal imbalances and anovulatory infertility. Further rigorous clinical trials are warranted to standardize dosages, safety, and efficacy for therapeutic application.
**Keywords**: *Female infertility, Plant extracts, Ovulation, Hormonal balance, Phytoestrogens, PCOS.*

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# Targeted Drug Delivery for Personalized Oncology: A Review of Nanoparticle Design and Clinical Applications

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**Background and Aim:** Conventional chemotherapy lacks specificity, causing systemic toxicity and limited efficacy in oncology. Nanoparticle-based targeted drug delivery offers a promising strategy to enhance therapeutic precision. This review aims to synthesize current evidence on the design of nanoparticles for personalized oncology and evaluate their clinical applications and outcome.
**Method:** A systematic literature search was conducted using PubMed, Scopus, and Web of Science databases. Keywords included "nanoparticle," "targeted drug delivery," "personalized medicine," "oncology," and "cancer therapy." Studies published between 2016 and 2026 focusing on nanoparticle design, functionalization, and clinical trials were included. Review articles and non-English publications were excluded.
**Results:** The analysis highlights advancements in nanoparticle engineering, such as ligand-based targeting and stimuli-responsive systems, which improve tumor-specific delivery. Clinical studies demonstrate enhanced drug bioavailability, reduced off-target effects, and improved patient survival in various cancers, including breast, lung, and pancreatic malignancies.
**Conclusion:** Nanoparticle-based targeted delivery systems represent a transformative approach in personalized oncology, offering potential for tailored treatments with improved efficacy and safety profiles. Future research should focus on scalable manufacturing and broader clinical validation.
**Keywords***: Nanoparticles, Targeted drug delivery, Personalized medicine, Oncology, Clinical applications.*

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# VHH Nanobodies as Next-Generation Biologics: From Bench to Bedside

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**Background and Aim:** VHH nanobodies, derived from camelid heavy-chain antibodies, have emerged as a transformative class of biologics capable of overcoming several limitations associated with conventional monoclonal antibodies. This review highlights the unique structural and functional characteristics of VHH nanobodies and explores their expanding therapeutic and diagnostic applications in modern precision medicine.

**Method:** A comprehensive literature review was conducted using published scientific articles and reviews focusing on VHH nanobodies, their molecular properties, engineering strategies, and clinical applications. Relevant studies addressing oncology, infectious diseases, molecular imaging, and intracellular targeting were evaluated to summarize current advances and translational potential.

**Results:** VHH nanobodies possess several advantageous features, including small molecular size (~15 kDa), high physicochemical stability, superior tissue penetration, and the ability to recognize cryptic epitopes inaccessible to conventional antibodies. Their simple genetic architecture supports rapid engineering into multivalent, bispecific, and fusion constructs. These nanobodies demonstrate enhanced distribution within solid tumors, the capacity to cross physiological barriers such as the blood–brain barrier, and suitability for intracellular targeting as intrabodies. Clinically, VHH nanobodies show promising applications in oncology through targeted therapy, immune modulation, molecular imaging, and CAR-T/CAR-NK cell engineering. In infectious diseases, they exhibit potent neutralizing activity with advantages in rapid development and inhalable delivery systems. Their high specificity and affinity further support diagnostic and imaging applications.

**Conclusion:** VHH nanobodies represent a versatile bench-to-bedside platform with significant potential to redefine next-generation biologics. Their unique structural and functional properties position them as promising tools for therapeutic, diagnostic, and precision medicine applications across diverse disease area.

***Keywords:*** *VHH nanobodies, Biologics, Precision medicine, Oncology, Molecular imaging, Intrabodies, Camelid antibodies.*

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# Memory-Associated Genes in Health and Disease: A Systematic Review of Neurogenetic Findings

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**Background and Aim:** Memory is a fundamental cognitive function governed by complex interactions between genetic, molecular, and neural circuit mechanisms. Dysregulation of memory-associated genes contributes to a spectrum of neurological and psychiatric disorders. This systematic review aimed to synthesize current neurogenetic evidence on genes implicated in memory processes across healthy and disease states, highlighting molecular pathways, translational relevance, and research gaps.

**Method:** A systematic literature search was conducted across major databases including PubMed, Scopus, Web of Science, and more. Keywords included combinations of "memory genes," "neurogenetics," "synaptic plasticity," "learning," "cognitive function," and "genetic memory disorders." Inclusion criteria comprised peer-reviewed original studies and reviews investigating genetic influences on memory in humans or animal models. Exclusion criteria included non-English articles, conference abstracts, and studies lacking genetic or neurobiological outcomes. Data screening and extraction were supported using Python-based workflows. AI-assisted tools, including Google NotebookLM and other machine-learning–supported literature synthesis platforms, were used to organize themes, summarize evidence, and enhance methodological rigor.

**Results:** Findings identified key gene clusters involved in synaptic plasticity, neurotransmission, neurotrophic signaling, and epigenetic regulation. Memory-related genes were consistently linked to long-term potentiation, hippocampal function, and cortical network modulation. Disease associations were prominent in neurodegenerative disorders, neurodevelopmental syndromes, and stress-related conditions, with convergent molecular pathways observed across models.

**Conclusion:** Memory emerges from highly coordinated neurogenetic networks spanning molecular to systems levels. Integrating genetics with neuroscience advances mechanistic understanding, biomarker discovery, and therapeutic targeting. Future research leveraging multi-omics and AI-driven analytics will further elucidate gene–brain–behavior relationships in memory health and disease.

**Keywords***: Memory-associated genes, Neurogenetics, Synaptic plasticity, Cognitive disorders, Gene expression.*

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# CD11b-CD27- NK Subsets Contribute to Immune Tolerance in HBV Infection Drived by TGF-β1/SMAD/RELA Pathway

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**Background and Aim:** The mechanism underlying immune tolerance in novel NK subsets in chronic hepatitis B（CHB）infection remains unclear.
**Method:** Peripheral blood mononuclear cells (PBMCs) were obtained from healthy controls (HCs) and CHB patients. The phenotype and function of NK subsets distinguished by CD11b and CD27 were analyzed by flow cytomety and serum cytokines by enzyme-linked immunosorbent assay (ELISA). Single-cell RNA sequencing (scRNA-seq) was applied to delineate the transcriptomic landscape of peripheral immune cells in CHB patients.
**Results:** $CD11b^{-}CD27^{-}$ (DN) NK subsets preferentially accumulated in patients in immune tolerant (IT) phase. These DN NK subsets displayed an immature and inactive phenotype and exerted poor degranulation and IFN-γ production, which contributed to NK tolerance in IT phase. Higher concentrations of transforming growth factor-beta 1 (TGF-β1) were detected in serum from IT patients, which positively correlated with DN subsets. We also profiled the transcriptomes of 98,354 cells from HCs and CHB samples using single-cell RNA sequencing and SCENIC analysis. Interestingly, we identified $CD11b^{-}CD27^{-}$ population with TGF-β1/SMAD/RELA activation in the PBMCs of IT patients.
**Conclusion:** TGF-β1 drives the expansion of aberrant expansion of DN NK subsets in IT phase, which may contribute to NK tolerance in HBV infection.
**Keywords***: CHB, Immune tolerance, NK subsets, CD27, CD11b, TGF-β1.*

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ABSTARCTS

# Therapeutic Potential of Grape (*Vitis vinifera*) Leaf and Fruit Extracts in the Management of Infertility: A Short Review

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**Background and Aim**: Grape (Vitis vinifera) extracts, rich in polyphenols like resveratrol, flavonoids, and anthocyanins, have demonstrated potent antioxidant, anti-inflammatory, and hormone-modulating properties in preclinical studies. This review aims to systematically evaluate the existing scientific evidence on the efficacy of grape leaf and fruit extracts in improving parameters related to infertility.
**Method:** A comprehensive literature search was conducted using the electronic databases PubMed, Scopus, Web of Science, and Google Scholar from inception to August 2023. The search utilized keywords and MeSH terms including ("grape extract" OR "Vitis vinifera" OR "resveratrol") AND ("infertility" OR "sperm quality" OR "ovarian function" OR "reproductive hormones"). Eligibility criteria included original in vitro, in vivo animal studies, and human clinical trials published in English that investigated the effects of grape extracts on reproductive outcomes.
**Results:** The reviewed studies consistently reported beneficial effects. Grape polyphenols were found to significantly improve sperm count, motility, and morphology in male models by reducing oxidative stress in seminal plasma. In female models, the extracts enhanced folliculogenesis, improved ovarian reserve, and regulated steroidogenesis. The primary mechanisms identified were the scavenging of reactive oxygen species (ROS), upregulation of antioxidant enzymes, reduction of apoptosis in gametes, and modulation of estrogen and testosterone pathways.
**Conclusion:** The collective evidence strongly suggests that grape leaf and fruit extracts hold considerable promise as adjuvants or nutraceuticals for mitigating infertility. Their multifaceted actions protect reproductive cells from oxidative damage and improve hormonal balance. Further robust human clinical trials are warranted to standardize dosage and confirm therapeutic efficacy in human subjects.
**Keywords**: *Grape extract, Infertility, Antioxidant, Resveratrol, Reproductive health.*

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# Advancing Precision Oncology: A Review on the Application of Genomics and Proteomics in Cancer Treatment

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**Background and Aim:** Cancer remains a leading cause of mortality worldwide, with traditional treatment approaches often limited by heterogeneity and resistance. The emergence of high-throughput technologies in genomics and proteomics has revolutionized cancer research, enabling comprehensive molecular profiling of tumors. This review aims to synthesize recent advancements in genomic and proteomic applications, highlighting their role in improving cancer diagnosis, prognosis, and the development of targeted therapies.

**Method:** A systematic literature search was conducted using PubMed, Scopus, Web of Science, and Google Scholar databases. Keywords included "cancer genomics," "proteomics in oncology," "precision medicine," "biomarkers," "targeted therapy," and "personalized treatment." Studies with a focus on review articles, clinical trials, and original research were considered providing evidence of genomic and proteomic applications in human cancers.

**Results:** Integrative genomic and proteomic analyses have identified novel biomarkers for early detection, subtyped tumors based on molecular signatures, and uncovered actionable mutations and protein pathways. These insights have facilitated the development of targeted therapies, such as kinase inhibitors and immunotherapies, improving patient outcomes. Challenges include data integration, validation of biomarkers, and accessibility of technologies.

**Conclusion:** Genomics and proteomics are pivotal in advancing precision oncology, offering tailored therapeutic strategies and enhancing treatment efficacy. Future efforts should focus on standardizing methodologies, expanding multi-omics integration, and ensuring equitable implementation in clinical practice.

**Keywords***: Cancer genomics, Proteomics, Precision medicine, Biomarkers, Targeted therapy.*

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ABSTARCTS

# Unveiling the Mysterious Darkness: Unlocking Marine Biotechnology for Blue Growth and Biodiversity Hotspots in the Indo-Pacific Ocean Ecosystem

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**Background and Aim:** The Indo-Pacific Ocean ecosystem, encompassing the Indian Ocean and the western and central Pacific regions, represents the largest and one of the most ecologically diverse marine ecosystems on Earth. Recognized as a global marine biodiversity hotspot, this region supports an extraordinary diversity of fish, crustaceans, mollusks, echinoderms, and marine plants. The present study highlights the ecological significance and marine biotechnology potential of the Indo-Pacific region while emphasizing its role in sustainable blue growth and biodiversity conservation.

**Method:** A comprehensive review of recent scientific findings related to marine biodiversity, marine bioresources, and biotechnology applications in the Indo-Pacific region was conducted. The study evaluated biological, ecological, and genetic research focusing on marine organisms such as sea cucumbers, sponges, corals, and jellyfish, together with their pharmaceutical and industrial applications. Conservation strategies, aquaculture management, and biodiversity monitoring approaches were also assessed in the context of sustainable utilization.

**Results:** Recent advances in marine biotechnology have revealed numerous bioactive compounds derived from Indo-Pacific marine organisms with promising pharmaceutical properties, including anti-cancer, anti-inflammatory, antioxidant, and wound-healing activities. The complex geography of the Indo-Pacific region, characterized by extensive coastlines, straits, archipelagos, and island systems, supports countless ecological niches that sustain highly diverse and unique marine species. Despite these discoveries, significant portions of the region remain biologically and genetically underexplored. Sustainable utilization of these marine

bioresources requires improved understanding of species taxonomy, reproductive ecology, population genetics, and evolutionary mechanisms. Effective conservation policies and responsible resource management are essential for maintaining ecological integrity while supporting food security and socioeconomic development.

**Conclusion:** The Indo-Pacific Ocean ecosystem possesses enormous untapped potential for marine biotechnology and sustainable blue economy development. Unlocking these opportunities requires an integrated approach combining scientific research, biodiversity conservation, responsible policy frameworks, and sustainable resource utilization. Advancing marine biotechnology within this ecologically rich yet underexplored region may contribute significantly to future pharmaceutical innovation, ecosystem preservation, and global blue growth initiatives.

**Keywords:** *Indo-Pacific, Marine biotechnology, Biodiversity hotspots, Blue economy, Conservation, Sustainable utilization, Marine bioresources.*

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# Effects of Foliar and Soil-applied Cobalt Combined with Humic Acid on Growth and Cobalt Biofortification of Pepper (*Capsicum annuum* L.)

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**Background and Aim:** Although cobalt (Co) is not an absolutely essential nutrient for plant nutrition, it is a fundamental element known for its beneficial effects on plants and also plays important roles in human and animal health. Cobalt deficiency is frequently observed in food products grown in soils with low cobalt content, and health problems are seen in humans and animals fed diets low in cobalt. In particular, cobalt biofortification in plants grown in low-cobalt soils is one of the most suitable options for increasing the cobalt content of plant products while also supporting plant growth. As a heavy metal, cobalt causes varying degrees of stress and yield losses in plant species at high application levels. This study aimed to determine the effects of cobalt applications via soil and foliar routes, in combination with humic acid, on the growth, yield, cobalt biofortification, and potential stress factors of the pepper plant.
**Method:** In a study conducted in a greenhouse environment, pepper plants were treated with varying doses of cobalt via soil and foliar application, in combination with humic acid. The growth of the pepper plants, fruit yield, cobalt content in leaves and fruits, total chlorophyll content, and total phenolic content were analyzed.
**Results:** Foliar and soil applications of cobalt increased plant lenght, fruit yield, cobalt content in leaves and fruits, and total chlorophyll content in pepper plants at low and medium application rates, whereas high application rates caused a decrease in these parameters. The total phenolic content in the leaves and fruits of pepper plants increased with both Co applications. It was determined that foliar Co applications caused higher stress on pepper plants. Co applied to the soil at a level of 40 $\mu mol^{-1}$ in combination with humic acid was sufficient to provide reliable Co biofortification in pepper fruit. It was found that in foliar cobalt applications, the cobalt content in pepper leaves was higher, whereas in soil-applied cobalt treatments, the cobalt content in pepper fruits was higher.
**Conclusion:** The results showed that low-to-medium levels of cobalt application to soil and leaves successfully improved plant growth, yield, and cobalt biofortification. However, cobalt application via both methods significantly increased stress factors in plants, and a significant decrease in growth and yield was recorded at high cobalt application levels.
**Keywords:** *Biofortification, Cobalt, Soil and Foliar Application, Humic acid, Pepper*

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# Effects of Caffeine and N-Acetylcysteine on Survival, Cardiac Function, Development and Behavior in Zebrafish (*Danio rerio*) Embryos and Larvae

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**Background and Aim:** Caffeine is one of the most widely consumed psychoactive substances worldwide and is increasingly detected in aquatic environments, raising concerns regarding its potential impact on non-target organisms. The present study investigated the effects of caffeine exposure, alone and in combination with N-acetylcysteine (NAC), on early developmental stages of zebrafish (*Danio rerio*), with the aim of assessing a potential protective effect of NAC.
**Method:** Embryos and larvae were exposed to caffeine at concentrations of 1 mg/L and 25 mg/L, administered either alone or in combination with NAC, resulting in six experimental groups including controls. Evaluated endpoints included mortality rate, heart rate, hatching success, and morphological abnormalities. In addition, locomotor behavior was assessed using a light–dark transition test to detect possible neurobehavioral alterations.
**Results:** Caffeine exposure induced concentration-dependent effects on survival and cardiac activity, with higher concentrations associated with increased mortality and significant alterations in heart rate. Developmental parameters, including hatching dynamics and the incidence of malformations, were also affected, particularly at 25 mg/L. Behavioral analysis revealed modifications in locomotor activity during light–dark transitions, indicating altered neurobehavioral responses.
**Conclusion:** Co-exposure with NAC attenuated several of the adverse effects observed in caffeine-treated groups, suggesting a potential protective role, likely related to its antioxidant properties.
**Keywords:** *Caffeine; N-acetylcysteine, Danio rerio, Embryos, Larvae, Developmental toxicity*

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# Neurobehavioral Effects of Ceftriaxone, Polystyrene Microplastics, and Their Mixture in Adult Zebrafish, Assessed Using the Novel Tank Test

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**Background and Aim**: The increasing release of pharmaceuticals and microplastics into aquatic environments has heightened concerns about their combined neurobehavioral impacts on aquatic organisms. Cephalosporin antibiotics and polystyrene microplastics (PS-MP) commonly coexist in freshwater ecosystems, but the effects of their combination are poorly understood. This study aimed to evaluate the individual and combined effects of ceftriaxone (CEF) and PS-MP on zebrafish behavior using the Novel Tank Test, focusing on anxiety-like behaviors, exploration, and locomotion.

**Method**: Adult zebrafish (Danio rerio) were exposed to 50 µg $L^{-1}$ CEF, 1 mg $L^{-1}$ PS-MP and their mixture under controlled laboratory conditions. Behavioral analysis was performed with the Novel Tank Test, measuring thigmotaxis, locomotor activity and rotational behavior. Statistical analyses were performed using one-way ANOVA, Dunnett's post-hoc test.

**Results**: Exposure to PS-MP resulted in hyperactivity, increased rotation frequency, and moderate stress responses. CEF induced moderate anxiety-like behavior characterized by reduced exploration. The mixture caused significant behavioral changes, such as increased rotations, reduced exploration of the upper zone, and increased immobility. The effects were greater than those caused by individual doses, suggesting a potential synergistic interaction.

**Conclusion**: Combined exposure to CEF and PS-MP causes significant and complex neurobehavioral changes in zebrafish, exceeding the effects of each pollutant alone. These findings highlight the relevance of considering combined toxicity when assessing the ecological threats posed by emerging contaminants in aquatic environments.

**Keywords***: Zebrafish, Novel tank test, Ceftriaxone, Microplastics, Neurobehavioral toxicity*

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# Physicochemical and Sensory Properties of Cookies Supplemented with Ziziphus Lotus Seed Flour

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**Background and Aim**: The growing need for sustainable food production and waste reduction has motivated the valorization of fruit by-products, particularly seeds and pulps, as potential sources of functional ingredients.
**Method**: This study aimed to evaluate the influence of Ziziphus lotus seed flour supplementation on cookies quality (32% and 64%). The proximate composition of Z. lotus pulp flour (ZPF) and seed (ZSF) and the functional properties (water, oil, and milk absorption capacity, swelling and foam capacity, and emulsifying activity) of flours were evaluated. The diameter, thickness, spread factor, and sensory evaluation of cookies were also evaluated.
**Results**: The proximate analysis shows that some parameters (moisture and carbohydrate content) were significantly ($p < 0.05$) higher in the pulp when compared to Ziziphus seed (12.49 ± 0.15% and 7.67 ± 0.22%, 78.25 ± 1.61% and 52.53 ± 1.02%), respectively, while other parameters such as ash, crude protein, and crude fat content were significantly ($p < 0.05$) higher in the seeds (6.39 ± 0.35% and 4.34 ± 0.13%), (9.54 ± 0.43 and 3.32 ± 0.14%), and (23.87 ± 0.42% and 0.83 ± 0.19%), respectively. The thickness and diameter of the cookies increased, but the spread decreased, due to the added seed flour. The proximate composition of the cookies supplemented with ZSF exhibited a lower moisture and carbohydrate content than the control (0% ZSF). The ash, protein, and fat content increase with the incorporation of ZSF. The findings indicate that higher substitution levels of ZSF had a higher overall acceptability.
**Conclusion**: This study demonstrates that ZSF can serve as valuable ingredients for the food industry, reducing agro-industrial waste while enhancing product nutrition. The findings indicate that higher substitution levels (up to 60%) can yield nutritionally superior and organoleptically acceptable cookies.
**Keywords*:*** *Ziziphus lotus, Pulp, Seed, Cookies, Proximate composition, Functional properties, Sensory evaluation.*

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