ACIBADEM
MEHMET ALİ AYDINLAR UNIVERSITY

EMK 2025 | MSC 2025

27. ULUSAL ELEKTRON MİKROSKOPİ KONGRESİ
27TH NATIONAL CONGRESS OF ELECTRON MICROSCOPY

2ND INTERNATIONAL MICROSCOPY AND SPECTROSCOPY CONGRESS
2. ULUSLARARASI MİKROSKOPİ VE SPEKTROSKOPİ KONGRESİ

25-27 EYLÜL 2025 / 25-27 SEPTEMBER 2025

ABSTRACT BOOK

ACIBADEM MEHMET ALİ AYDINLAR UNIVERSITY SCHOOL OF MEDICINE, DEPARTMENT OF HISTOLOGY AND EMBRYOLOGY

ACIBADEM UNIVERSITY CONGRESS CENTER
ATASEHIR, ISTANBUL

www.temdcongress25.org.tr

Dear Colleagues,

It is our great pleasure to welcome you to the 27th National Congress of Electron Microscopy (EMK 2025) and the 2nd International Microscopy and Spectroscopy Congress (MSC 2025), which are organized under the auspices of the Turkish Society for Electron Microscopy and hosted by Department of Histology and Embryology, School of Medicine, Acıbadem Mehmet Ali Aydınlar University, Istanbul, in September 25 to 27, 2025.

Both congresses welcome all microscopy studies in the fields of life sciences and material sciences. We believe that our congresses will contribute to the creation of a scientific environment where microscopy studies will be presented and discussed with the participation of valuable scientists who are experts in their fields, as well as contributing to close cooperation and collaborations including social interactions. Technical presentations and exhibitions of our sponsor companies regarding recent developments in the field of microscopy are included in the congress content.

The Congress venue, Acıbadem University Congress Center, equipped with states-of-arts congress facilities, is situated in city center with an easy access to subway and Marmaray rail line that connects the asian and european sides of the city.

The scientific program includes a series of 1 keynote, 3 plenary lectures, 57 invited lectures, 45 oral presentations and 57 poster presentations from distinguished scientists on microscopy. We appreciate all the esteemed invited speakers and congress participants for their great contributions.

"Prof. Dr. Ayşe Oğuz- Best Poster Award MSC 2025'', **"Prof. Dr. Meral Baka- Best Poster Award EMK 2025** 'and '**Prof. Dr. Mahmut Sağlam Best Microstructure Award** " will be presented at both congresses. **"Prof. Dr. Türkan Erbengi Research Award"** which is organized biennially by the Turkish Society for Electron Microscopy in honor of Founding President, Prof. Dr. Türkan Erbengi, will be awarded in the fields of materials sciences and biological sciences in 27th National Congress of Electron Microscopy this year.

Additionally, **"Microscopy School- 3 D Cell Culture & Neurohistology Courses"** will be organized in the first day of the congress on September 27, 2025 in excellent infrastructure of microscopy labs of the campus.

Our congress is organized in accordance with international conference standards. All accepted and presented papers in both congresses will be included in the conference abstract book after undergoing a peer-review process.

The participation and contributions of esteemed microscopists undoubtedly enrich our congresses and the microscopy community.

On behalf of Organizing Committee of Congresses and the Executive Board of the Turkish Society for Electron Microscopy, we wish you all an inspiring, successful and enjoyable congress.

We extend our warmest regards and deeply appreciate your valuable participation.

On behalf of the Organizing Committee,

Prof. Dr. Serap ARBAK
Congress Chair- EMK 2025 & MSC 2025/President-Turkish Society for Electron Microscopy

Prof. Dr. Servet TURAN
Vice Chair- Turkish Society for Electron Microscopy

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MSC 2025
BIOLOGICAL SCIENCES
PROGRAMME

SEPTEMBER 25, 2025

08:30-17:00	**REGISTRATION**
09:00-14:00	**MICROSCOPY SCHOOL**
14:00-14:45	**OPENING CEREMONY - Conference Hall** **Opening and Welcoming** **Moment of Silence** **National Anthem** **Prof. Dr. Serap Arbak,** Chair-MSC 2025 and EMK 2025 / President- Turkish Society for Electron Microscopy **Prof. Dr. Güldal Süyen,** Vice Rector- Acıbadem Mehmet Ali Aydinlar University **Music Performance,** Gizem Kosif (Piano) & Can Gözüm (Saxophone) **Tango Dance Performance,** Melis Aydın & Barış Karahasan
14:45-15:30	**KEYNOTE LECTURE - Conference Hall** Chairs: **Serap Arbak, Servet Turan**
	Vladislav Krzyzanek - President of the European Microscopy Society Unlocking the Power of SEM: Quantitative Imaging and 4D Diffraction Across Disciplines
15:30-16:00	**COFFEE BREAK**
16:00-16:40	**PLENARY LECTURE 1 - Conference Hall** Chairs: **Melek Öztürk, Deniz Yücel**
	Ali Ertürk AI-Powered 3D Cell-Level Imaging for Disease Studies and Therapeutic Development
16:40-18:40	**PARALLEL SESSIONS** **BS Session 1 - Neuroscience - Conference Hall** Chairs: **Özhan Eyigör, Filiz Onat**
16:40-17:10	**Tamas Horvath - ZOOM (Invited)** Uncoupling of Aging from Cancer Propagation by Hypothalamic Feeding Circuits Involving the Immune System
17:10-17:40	**Bülent Ahıshalı (Invited)** Blood-Brain Barrier as an Obstacle in the Treatment of Neurodegenerative Diseases; Current Considerations and Novel Approaches
17:40-18:10	**Stefan H. Fuss (Invited)** Visualizing Nervous System Regeneration in Zebrafish.
	Oral Presentations
18:10-18:20	**OP-0079** **Sena Eyüpreisoğlu** Protective Effects of Neuropeptide W on Cortex and Hippocampus of Rats Induced with Cerebral Ischemia/ Reperfusion
18:45	**WELCOME RECEPTION (Aplus Cafeteria)**

SEPTEMBER 25, 2025

16:40-18:40 **PARALLEL SESSIONS**

BS Session 2 - Cancer - D102 Hall
Chairs: **Gamze Güney, Gamze Tanrıöver**

16:40-17:10 **Şevin Turcan - ZOOM (Invited)**
The Role of IDH Mutations in Brain Tumors

17:10-17:40 **Roya Khosravi-Far (Invited)**
Multiomics in Minutes: The Next Frontier of Non-Invasive Cancer Diagnostics

Oral Presentations

17:40-17:50 **OP-0031**
Hilal Kabadayı Ensarioğlu
The lysine methyltransferase Smyd4 functions as a tumor suppressor in pancreatic ductal adenocarcinoma by targeting the histone H3K9

17:50-18:00 **OP-0037**
Ece Oylumlu
In vitro evaluation of a multi-kinase inhibitor TAS-115 on Temozolamide sensitive U87MG cells

18:00-18:10 **OP-0096**
Ayşe Seda Akdemir
Effect of Ribociclib, a CDK4/6 inhibitor, on ribosomal proteins RPL22L1 and FAU in glioblastoma cell lines

18:10-18:20 **OP-0044**
Sendegul Yildirim
3D bioprinting of a patient-derived breast cancer organoid model for immunotherapeutic screening

18:45 **WELCOME RECEPTION (Aplus Cafeteria)**

SEPTEMBER 26, 2025

08:30-17:00	**REGISTRATION**
09:00-09:40	**PLENARY LECTURE 2 - Conference Hall** Chairs: **Güldal Süyen, Merve Elmas**
	Emre Yakşi The Role of Astroglia in the Generation and Prevention of Seizures
09:40-10:10	**COFFEE BREAK**
10:10-12:10	**PARALLEL SESSIONS**
	BS Session 3 - Cell I - Conference Hall Chairs: **Oya Evirgen, Kamila Hrubanova**
10:10-10:40	**Toyoshi Fujimoto - ZOOM (Invited)** Lipid Droplets and Nuclear Structures
10:40-11:10	**Roberta Di Pietro - ZOOM (Invited)** The Heterogeneous Blueprint: Regional Mapping of the Human Amniotic Membrane and Its Implications in Fundamental Research and Translation
11:10-11:40	**Volkan Erkut (Invited)** Life Sciences Applications on FIB-SEM
	Oral Presentations
11:40-11:50	**OP-0055** **İbrahim Alptekin** Association of VEGFR-2 expression in mesenchymal stroma cells with angiogenesis in preeclampsia
11:50-12:00	**OP-0062** **Ezel Erkan** The overlooked residents of the umbilical cord: telocyte-like cells in stromal microenvironment
12:10-13:30	**POSTER SESSION - Exhibition Hall**
13:30-14:30	**LUNCH**

SEPTEMBER 26, 2025

14:30-16:30	**PARALLEL SESSIONS** **BS Session 5 - Cell Death - Conference Hall** Chairs: **Gözde Erkanlı Şentürk, Figen Kaymaz**
14:30-15:00	**Barbara Conradt (Invited)** Life Super-Resolution Imaging of Programmed Cell Death
15:00-15:30	**Tuğba Bağcı Önder (Invited)** Can we Increase the Therapy Response of Brain Tumors by Epigenetic Interventions?
15:30-16:00	**Meltem Sezen Özkoç (Invited)** Hydra Bio Plasma-FIB Technologies for Multidisciplinary Research
16:00-16:30	**David Westmoreland (Invited)** Cryogenic TEM Sample Holder and MEMS-Chips Development for In Situ Cooling, Heating and Biasing Applications
16:30-17:00	**COFFEE BREAK**
17:00-19:00	**PARALLEL SESSIONS** **BS Session 7 - Biomaterials - Conference Hall** Chairs: **Ipsita Roy, Halime Kenar**
17:00-17:30	**Bahattin Koç (Invited)** Biomimetic Bioprinting for Tissue/Organ Engineering
17:30-18:00	**Ipsita Roy (Invited)** Natural and Sustainable Polymers of Bacterial Origin and Their Biomedical Applications
18:00-18:30	**Özgül Gök Özatay (Invited)** Morphological Evaluation of Biomolecule-Conjugated Nanomedicine Platforms
18:30-19:00	**Bükem Tanören (Invited)** Theranostics
20:00	**GALA DINNER**

SEPTEMBER 26, 2025

10:10-12:10	**PARALLEL SESSIONS** **BS Session 4 - Cell II - D102 Hall** Chairs: **Beki Kan, Agnes Kittel**
10:10-10:40	**Alp Can (Invited)** Revisiting the Human Umbilical Cord. Unique Cells in a Surprisingly Fibrous Stroma
10:40-11:10	**Pavel Hozak (Invited)** Imaging Gene Transcription
11:10-11:40	**Agnes Kittel (Invited)** Deciphering the Secrets of Extracellular Vesicles or the Limits of Classical TEM Examinations
11:40-12:10	**Seda Vatansever (Invited)** Exosomes: Tiny Packages, Transformative Potential Biogenesis and Their Role in Medicine
12:10-13:30	**POSTER SESSION - Exhibition Hall**
13:30-14:30	**LUNCH**
14:30-16:30	**PARALLEL SESSIONS** **BS Session 6 – Advanced Microscopy Techniques – D102 Hall** Chairs: **Naoto Kawakami, Esra Erdemli**
14:30-15:00	**Naoto Kawakami (Invited)** Intravital Imaging of Lymphocytes Using Multi-Photon Microscopy
15:00-15:30	**Serçin Karahüseyinoğlu (Invited)** Microscopy in Transition: From Optical Lenses to Intelligent Algorithms
15:30-16:00	**Rahul Kumar (Invited)** Fast and Gentle Live Imaging with Spinning Disk Confocal Microscopy in Life Sciences
16:00-16:30	**Gaurav Sharma (Invited)** Redefining 2D/3D Imaging: Introducing new 120kV TEM
16:30-17:00	**COFFEE BREAK**

SEPTEMBER 26, 2025

17:00-19:00 **PARALLEL SESSIONS**

BS Session 8 - Developmental Biology - D102 Hall
Chairs: **Feriha Ercan, Abit Aktaş**

17:00-17:30 **Marisa Bartolomei - ZOOM (Invited)**
Morphological and Epigenetic Outcomes in a Mouse Model of Assisted Reproductive Technologies

17:30-18:00 **Leyla Satı (Invited)**
Pushing the Boundaries of Developmental Biology: A Technological Tour de Force in Creating True Interspecies Hybrids with Both a Hybrid Genome and Hybrid Cytoplasm

OP Session 1 – Tissue and Systems I - D102 Hall
Chairs: **Deniz Yücel, Pınar Köroğlu**

18:00-18:10 **OP-0028**
Merve Gorgulu
Acetyl-L-carnitine as a modulator of steroidogenic dysfunction induced by chronic ethanol exposure

18:10-18:20 **OP-0046**
Seda Keskin
Investigation of the effects of Bergenin on CD4+T cells in imiquimod-induced psoriasis mouse model

18:20-18:30 **OP-0027**
Aygun Aliyarbayova
Dynamical ultrastructural evaluation of variation respiratory ciliated epithelial cells under administration of Macrophage Migration Inhibitory Factor: Animal model of study

18:30-18:40 **OP-0115**
Selenay Furat
Effects of dapagliflozin on the reproductive system in aged male rats

18:40-18:50 **OP-0116**
Gökçen Özgün
Comparison of two treatment approaches for TAA-induced liver injury: Hydrogel injection or hydrogel integrated fibrous mesh implant

20:00 **GALA DINNER**

SEPTEMBER 27, 2025

08:30-17:00	**REGISTRATION**
09:00-09:40	**PLENARY LECTURE 3 - Conference Hall** Chairs: **Feray Bakan Mısırlıoğlu, Mehtap Kutlu**
	Aydoğan Özcan - ZOOM AI-based Advances in Biomedical Microscopy and Pathology
09:40-10:00	**COFFEE BREAK**
10:00-12:30	**PARALLEL SESSIONS**
	BS Session 9 - Cell III - Conference Hall Chairs: **Selma Yılmazer, Fatma Kaya Dağıstanlı**
10:00-10:30	**Michelangelo Campanella - ZOOM (Invited)** The Mitochondrial Relay with the Nucleus: Form and Function
10:30-11:00	**Batu Erman (Invited)** Condensates that Control Transcription Factor Dimerization
11:00-11:30	**Nalan Liv (Invited)** Resolving Subcellular Structure Alterations in Cancer with (Correlative) Light and Electron Microscopy
11:30-12:00	**Lakshmi Edakkandiyil (Invited)** Rewiring of Organelle Ultrastructure in HER2-Positive Breast Cancer Revealed through Volume Electron Microscopy
12:00-12:30	**Zahra Elly Soltani (Invited)** Visualization of EV Biogenesis and Secretion Using Advanced Light and Electron Microscopy
12:30-13:30	**LUNCH**
13:30-15:30	**BS Session 11- Organoids - Conference Hall** Chairs: **Dilek Akakın, Gamze Tanrıverdi**
13:30-14:00	**Jitske Jansen - ZOOM (Invited)** Human Kidney Organoids to Model Glomerular Disorders and Kidney Fibrosis
14:00-14:30	**Ranan Gülhan Aktaş (Invited)** Recent Advances in 3D Cell Culture: Revolutionizing Drug Discovery and Disease Modeling Through Advanced Technologies
14:30-15:00	**Çiler Çelik Özenci (Invited)** Enhanced Human Placenta Organoids with Immune and Vascular Components for In Vivo-Like Function, Disease Modeling, and Therapeutic Testing
15:00-15:30	**Kaya Bilgüvar (Invited)** Genetics and Modeling of Neurological Disorders
15:30-15:45	**COFFEE BREAK**
17:30-18:00	**CLOSING AND AWARD CEREMONY (Conference Hall)**

SEPTEMBER 27, 2025

10:00-12:30	**PARALLEL SESSIONS**
	BS Session 10 - Microbiology - D102 Hall Chairs: **Engin Yenilmez, Özgür Kurt**
10:00-10:30	**Tanıl Kocagöz (Invited)** Investigation of Mechanism of Action of Newly Developed Wide Spectrum Peptide Antibiotics by Electron Microscopy
10:30-11:00	**Ahmet Özbilgin (Invited)** The Role of Microscopy in the Diagnosis of Parasitic Diseases
11:00-11:30	**Caner Akıl (Invited)** Investigating Virus Infection Mechanisms in Situ
11:30-12:00	**Esra Balıkçı Akıl (Invited)** Decoding the Replication Machinery of Nipah Virus: Structural and Molecular Insights
12:00-12:30	**Felice D'Alia - Ass. General Manager within JEOL (EUROPE) SAS. (Invited)** Total Solution For Air/Beam Sensitive Samples
12:30-13:30	**LUNCH**
15:45-17:30	**ORAL PRESENTATIONS**
	OP Session 2 – Tissue and Systems II - D102 Hall Chairs: **Özlem Tuğçe Çilingir Kaya, Esin Yuluğ**
15:45-15:55	**OP-0067** **Sümeyye Güney** Alleviating effects of estrogen receptor activation in an indomethacin-induced gastric mucosal damage in rats
15:55-16:05	**OP-0075** **Elif Kervancıoğlu Demirci** Ceratonia siliqua protects testicular tissue in ischemia/reperfusion injury
16:05-16:15	**OP-0087** **İpek Yılmaz Düzgün** Dose-dependent assessment of radiotherapy-induced ovarian damage in mice: differential gene expression profiling and ovarian function
16:15-16:25	**OP-0064** **Gulam Hekimoğlu** Evaluation of miR-210, 146a-5p, 26a-5p, 223-3p, 155, and 93-5p expression in allograft tissues of patients with corneal rejection after transplantation
16:25-16:35	**OP-0093** **Goksan Inci Durmaz** Vitamin D supplementation in non-alcoholic fatty pancreas disease: insights from an experimental model of metabolic syndrome
16:35-16:45	**OP-0102** **Samira Yaqubova** Ultrastructural Characteristics of The Thyroid and Adrenal Glands During Acute Hypoxia
17:30-18:00	**CLOSING AND AWARD CEREMONY (Conference Hall)**

SEPTEMBER 27, 2025

15:45-17:30	**ORAL PRESENTATIONS**
	OP Session 3 – Biomaterials – D103 Hall Chairs: **Duygu Gök Yurtseven, Başak Işıldar**
15:45-15:55	**OP-0106** **Dila Hatun Sal** Development and Evaluation of VEGF-Contained Polyhydroxyalkanoate (PHA) Scaffolds for Enhanced Peripheral Nerve Regeneration: A Comprehensive In Vitro, Ex Ovo CAM, and In Vivo Analyses
15:55-16:05	**OP-0083** **Serbay Ozkan** Performance analysis of commercial superparamagnetic iron oxide nanoparticles for magnetic particle imaging-based mesenchymal stem cell tracking
16:05-16:15	**OP-0088** **Ayşe Işık** Interaction of mesoporous silica nanocarriers with photodynamic agents: microscopic analysis of morphology and intracellular distribution
16:15-16:25	**OP-0022** **Hafize Seda Vatansever** Formulation and analysis of gellan gum hybrid hydrogels with silk fibrin and sodium alginate for enhanced culturing of mouse embryonic stem cells and extracellular matrix simulation
	OP Session 4 – Microscopy Techniques – D103 Hall Chairs: **Elif Kervancıoğlu Demirci, Merve Elmas**
16:25-16:35	**OP-0033** **Kazım Hilmi Or** Digital twins in illumination and colour in microscopy and spectroscopy
16:35-16:45	**OP-0034** **Kazım Hilmi Or** State-of-the-art applications of artificial intelligence in illumination control in microscopy
16:45-16:55	**OP-0099** **Ekin Baysal** Qualitative assessment of physicochemical variables in classical Golgi and Golgi-Cox staining
17:05-17:15	**OP-0059** **Ceren Çelik** Fourier Transform Infrared Microscopy (FTIRM) for multimodal characterization of disease- and drug-induced tissue alterations
17:30-18:00	**CLOSING AND AWARD CEREMONY (Conference Hall)**

KEYNOTE LECTURE

Unlocking the Power of SEM: Quantitative Imaging and 4D Diffraction Across Disciplines

Vladislav Krzyzanek

Institute of Scientific Instruments of the CAS, v.v.i. The Czech Academy of Sciences Kralovopolska , Brno, Czech Republic

Electron microscopy continues to expand the frontiers of materials and life science research. This lecture explores significant advancements in Scanning Electron Microscopy (SEM), moving beyond conventional imaging to include quantitative, diffraction-based, and 4D analysis capabilities. The power of conventional STEM-in-SEM will first be demonstrated, showcasing its effectiveness for high-resolution imaging of biological specimens, such as ultrathin sections, without the need for conventional heavy metal staining. In addition to delivering excellent contrast and resolution, this technique can be fully quantitative, allowing for precise measurements of molecular mass and thin film thickness.

Transformative potential of 4D-STEM-in-SEM will be highlighted, leveraging advanced pixel detectors such as Timepix. This innovation significantly extends the quantitative imaging capabilities of SEM and opens new avenues, including user-friendly powder diffraction in SEM. Importantly, it enables this traditionally materials-focused method to be applied to biological samples—for instance, to identify and localize trace amounts of crystalline nanoparticles within biological sections.

Through recent technological developments and illustrative case studies, this lecture will demonstrate how combining enhanced imaging with advanced diffraction—the 4D-STEM-in-SEM technology—transforms SEM into a versatile and powerful platform for gaining unprecedented insights into both hard and soft matter systems.

References:

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PLENARY LECTURES

AI-Powered 3D Cell-Level Imaging for Disease Studies and Therapeutic Development

Ali Ertürk

Max–Planck–Institute of Neurobiology, Munich, Germany

Understanding complex diseases requires observing them at the level of individual cells across entire organs and systems. In our work, we combine advanced tissue clearing, high-resolution 3D imaging, and deep learning to map whole mouse bodies and large human tissues at single-cell resolution. These datasets enable unbiased cellular atlases across organs and disease states, including cancer, neurodegeneration, metabolic disorders, infections, and environmentally driven conditions. By integrating imaging with spatial proteomics, we identify molecular signatures that link cell organization to pathology and therapy response. Building on this foundation, we apply AI to design therapeutic molecules and delivery strategies with high precision for selected cell types. This approach connects microscopy-driven discovery with targeted therapeutic development, offering a framework to translate cell-level insights into actionable treatments.

AI-based advances in biomedical microscopy and pathology

Aydogan Ozcan

Electrical and Computer Engineering Department, Bioengineering Department, California NanoSystems Institute
UCLA, University of California, Los Angeles, CA

I will provide an overview of our recent work on using deep neural networks in advancing computational microscopy and sensing systems, also covering their biomedical applications. Specifically, I will discuss emerging opportunities to revolutionize tissue staining methods by digitally generating histological stains using trained deep neural networks, providing rapid, cost-effective, accurate and environmentally friendly alternatives to standard chemical tissue staining methods. These deep learning-based virtual staining techniques can successfully generate different types of histological stains, including immunohistochemical stains, from label-free microscopic images of unstained samples by using, e.g., autofluorescence microscopy, quantitative phase imaging and reflectance confocal microscopy. Our team also demonstrated similar approaches for transforming images of an already stained tissue sample into another type of stain, performing virtual stain-to-stain transformations. Finally, I will discuss our work on a paper-based sensors enabled by AI for multiplexed and cost-effective sensing of a panel of biomarkers within ~15 min using a mobile phone-based device.

The Role of Astroglia-Neuron Interactions in Network Hyperexcitability and Seizures

Emre Yakşi

Kavli Institute for Systems Neuroscience, Trondheim, Norway

Astroglial cells play an important role in multiple brain processes. These range from maintaining metabolic homeostasis to regulating key aspects of brain development, fostering connectivity and computations within neural circuits. Accumulating evidence indicates that aberrant astroglial functioning contributes to the pathophysiology observed across diverse forms of epilepsy. Previously we demonstrated distinct calcium dynamics in neurons and astroglia transitioning from pre-ictal to ictal activity and upon photic stimulation in hyperexcitable networks. In pre-ictal periods neurons exhibited local synchrony, whereas astroglia were highly active with global synchrony. Generalized seizures, however, were marked by release of astroglial glutamate as well as a drastic increase of astroglial and neuronal activity and synchrony across the brain. Knocking out astroglial glutamate transporters led to recurrent spontaneous seizures, accompanied by massive astroglial glutamate release, overall resembling a neonatal form of epileptic encephalopathy. Currently, we are using a combination of genetic and pharmacological approaches to perturb astroglial calcium and glutamate signalling and glia-neuron interactions to further investigate their role in generation and spread of epileptic seizures. To achieve this, we utilize functional dual channel recording in zebrafish expressing neuronal and astroglial calcium indicators, as well as glutamate sensors in controls and seizure prone animals. Our perturbations of astroglial glutamate transporters alter these dynamics and the animals' seizure susceptibility, suggesting astroglia as potential targets in the development of novel therapeutical approaches. Currently, we are using spatial and single-cell transcriptomics approaches to identify and map spatial distributions of distinct glial and neural populations across zebrafish forebrain and relate our findings to other vertebrates.

INVITED SPEAKERS

Uncoupling of aging from cancer propagation by hypothalamic feeding circuits involving the immune system

Tamas L. Horvath

Department of Comparative Medicine, Yale School of Medicine, New Haven, CT 06511, USA

Balanced chronic calorie restriction, a form of negative energy balance, can promote health- and lifespan in all species so far studied. Because negative energy balance is associated with activation of hypothalamic hunger-promoting neurons that express Agouti-related peptide (AgRP), we sought to determine the putative role of AgRP neurons in health and lifespan of mice. Here we show that the cellular integrity of AgRP neurons is preserved during chronological aging, and that chronic calorie restriction elevates the activity of these cells. Cell-selective knockdown of the histone deacetylase, sirtuin 1 (Sirt1), from AgRP neurons, which is known to render these neurons less responsive to cues of negative energy balance, altered behavioral adaptations of mice to chronic calorie restriction, and resulted in shortening of mean life span of male mice fed *ad libitum*. In contrast, despite of many overlapping phenotypic alterations, $AgRP^{Sirt1-/-}$ female mice had no difference in their lifespan compared to their controls. Necropsy of mice unmasked a striking outcome, which was decreased disease burden and neoplastic events particularly in male $AgRP^{Sirt1-/-}$ mice. To interrogate whether tumor growth is affected in these animals, we have injected $AgRP^{Sirt1-/-}$ male and female mice and their littermate controls with melanoma cell lines. We observed altered T cell responses in the tumor environment in male and female $AgRP^{Sirt1-/-}$ mice. However, while male mice with impaired AgRP neurons showed diminished mass cancerous cells compared to control males, females $AgRP^{Sirt1-/-}$ mice showed increase cancer growth relative to their control littermates. These observations unmask uncoupling of chronological aging from cancer propagation governed by hypothalamic cells via likely mediation of altered peripheral T cell functions.

Blood-brain barrier as an obstacle in the treatment of neurodegenerative diseases; Current considerations and novel approaches

Bulent Ahishali

Department of Histology and Embryology, Koç University School of Medicine, Istanbul, Turkey

The blood-brain barrier (BBB), primarily constituted by endothelial cells of brain microvessels strictly limits and controls the transport of substances between the blood and brain. Owing to the functionality of such a dynamic and highly selective barrier, the brain is protected from the potentially toxic substances in the circulation, an optimal microenvironment essential for proper functioning of the neurons is achieved and brain homeostasis is maintained. Accumulated data have shown that a variety of central nervous system diseases/disorders including epilepsy, ischemic stroke, multiple sclerosis, traumatic brain injury, and Alzheimer's disease are associated with BBB disruption. However, the question of whether BBB disruption is a cause or a consequence of neurodegenerative insults or perhaps both is still unsolved. Therapeutic strategies targeted at the restoration of the disrupted BBB in various clinical and experimental settings have been closely related to the alleviation of the underlying pathology. On the other hand, in the presence of a structurally and functionally intact BBB, a great deal of small and large molecule drugs and pharmacological agents cannot penetrate the brain at effective doses. A growing body of evidence shows that BBB remains a major obstacle to the successful delivery of drugs into the brain for the treatment of disorders/diseases involving the central nervous system. In this presentation, the recent development of innovative therapeutic modalities to overcome the obstacle of BBB and enhance the brain access of therapeutic agents for the treatment of neurodegenerative diseases will be overviewed. In addition, the recent work of our research team on the effectiveness of the experimental use of antiepileptic agents bound to gold nanoparticles coated with glucose to target glucose transporter-1 carrier located on the barrier type brain capillary endothelial cell membrane in the treatment of drug-resistant epilepsy will be discussed.

Keywords: Blood-brain barrier, nanocarriers, tight junctions; paracellular permeability; transcellular permeability

Visualizing nervous system regeneration in zebrafish

Stefan H. Fuss

Bogazici University, Molecular Biology and Genetics, Istanbul, Türkiye

Compared to other tissues, the nervous system has only a limited capacity for structural and functional repair. A major impediment to successful tissue regeneration is the paucity of active stem cell niches that support nerve cell regeneration following traumatic injury. We use the zebrafish nervous system as an experimental model to identify and functionally test molecular signals that modulate stem/progenitor cell activity. Heparin-binding epidermal growth factor-like growth factor (HB-EGF) is strongly and transiently upregulated in an experimental model of nerve cell injury. Stimulation of the intact tissue with recombinant protein promotes progenitor cell expansion and neurogenesis, while inhibition of HB-EGF signaling impairs progenitor cell proliferation in response to injury, suggesting that HB-EGF signaling is both necessary and sufficient for olfactory system regeneration.

The Role of IDH Mutations in Brain Tumors

Şevin Turcan

University Hospital Heidelberg. Department of NeurologyHeidelberg, Germany

Recognize™: A Multiomics, Saliva-Based Diagnostic Platform for Early Detection and Risk Stratification of Head and Neck Cancer at the Point of Care

Hasitha Gamage[1], Beth Grifith[1], Adityavikram Gurao[1], Ali Shazib[2], Shaiba Sandhu[2], and Roya Khosravi-Far[1,3]

[1]InnoTech Precision Medicine, Inc., Greater Boston Area, Massachusetts, USA, [2]High Point University and Workman School of Dental Medicine, High Point, North Carolina, USA, Beth Israel Deaconess Medical Center a Teaching Hospital of Harvard Medical School, Boston, Massachusetts.

Early detection of oropharyngeal squamous cell carcinoma (OPSCC), especially in HPV-positive and HPV-negative subtypes, remains a critical unmet need due to the limitations of current diagnostic methods, which rely on invasive biopsies, centralized labs, and delayed turnaround times. InnoTech Precision Medicine has developed **Recognize™**, a first-in-class, saliva-based diagnostic platform that integrates **genotypic and phenotypic biomarkers** into a rapid, point-of-care system. This platform combines proprietary amplification chemistry, a single-use test cartridge, and real-time fluorescence detection with AI-driven interpretation to deliver clinically actionable results in under 30 minutes.

Validated in simulated human studies with over 95% accuracy, Recognize™ supports **decentralized cancer screening** in dental, community, and mobile health settings—particularly for underserved and high-risk populations. By enabling early detection and individualized risk stratification without the need for complex infrastructure, the platform aims to reduce diagnostic delays, improve patient outcomes, and support health equity on a global scale. This presentation will highlight the platform's analytical performance, multiomics approach, and potential for regulatory clearance under CLIA-waived or De Novo FDA pathways.

Lipid droplets and nuclear structures

Toyoshi Fujimoto

Research Institute for Diseases of Old Age, Juntendo University Graduate School of Medicine, Tokyo, Japan

Lipid droplets (LDs) were once considered static reservoirs of excess lipids, but are now recognized as dynamic organelles with multiple functions. While most LDs are generated at the ER and reside in the cytoplasm, LDs are also present in the nucleus. We have focused on these nuclear LDs and identified two distinct pathways for their biogenesis (Fujimoto, Curr Op Cell Biol 88, 102370, 2024). Nuclear LDs in hepatocytes originate from accumulation of lipoprotein precursors in the lumen of the nuclear envelope (Solytsik et al, Nat Commun 10, 473, 2019), whereas those in non-hepatocytes are geneated at the inner nuclear membrane (INM) by a mechanism similar to cytoplasmic LD formation in the ER (Solytsik et al, 220, e202005026, 2021). Intriguingly, nuclear LDs formed by either pathway are located in the core of PML nuclear bodies (PML NBs).

In the ongoing study, we investigated how LDs can be localized within PML NBs, which are typically considered protein condensates. We examined nuclear LDs that are generated in amino acid-deprived conditions by an autophagy-dependent mechanism, and found that diacylglycerol (DAG), produced by ATGL-mediated hydrolysis of triacylglycerol (TAG) in cytoplasmic LDs, flows into the INM, and promotes nuclear LD formation. Furthermore, DAG in the INM is trafficked via small vesicles to PML NBs, which we found to constitutively harbor vesicles. This vesicle formation is mediated by an interaction between DAG and a specific PML isoform, and is abolished in PML knockout cells (Maeda et al, under revision).

These findings uncover a previously unrecognized class of vesicles in the nucleus that link PML NBs to TAG metabolism and calls for a reconsideration of our current view of PML NB architecture.

The Heterogeneous Blueprint: Regional Mapping of the Human Amniotic Membrane and Its Implications in Fundamental Research and Translation

Roberta Di Pietro

Department of Medicine and Ageing Sciences, G. d'Annunzio University of Chieti-Pescara, Italy

The human amniotic membrane (hAM), the innermost layer of the fetal membranes, is often considered a uniform tissue. However, our research provides compelling evidence that this is not the case. We have conducted a detailed **in situ morphofunctional mapping** of the hAM, revealing the presence of four distinct regions: **central, intermediate, peripheral, and reflected**. These regions, defined by their position relative to the umbilical cord, exhibit significant differences in the morphology, pluripotency marker expression, differentiation and secretory capacity of their human amniotic epithelial cells (hAECs).

This newly discovered regional heterogeneity is crucial for both **fundamental research and clinical translation**. By understanding these distinctions, we can optimize the isolation and application of hAM for specific tissue engineering and regenerative medicine purposes. Furthermore, this mapping provides valuable insights into the developmental biology and function of the placenta and its associated membranes. The knowledge gained from this work adds new insight into hAM structure and function, paving the way for the development of more targeted and effective therapies and moving beyond a one-size-fits-all approach.

Life sciences applications on FIB-SEM

Volkan Erkut[1]

[1] Carl Zeiss Teknoloji Çözümleri Tic. Ltd. Şti., Research Microscopy Solutions (RMS)

FIB-SEM (Focused Ion beam and Scanning Electron Microscope) technique is being widely used for life science research and its usage is expanding year by year. Ion milling, deposition and TEM lamella preparation are useful for determining the 3D features of biological specimens. For this purpose, this presentation will guide espacially new researchers and expand their knowledge of micro/nano investigation.

FIB-SEM systems are advanced technological instruments that integrate an electron column with an ion column. While the electron column enables imaging of samples with nanometer-scale resolution and magnification, the ion column allows site-specific modifications such as milling, polishing, and patterning with the same level of precision. These systems are widely used in the life sciences, where the internal structures of resin-embedded or fixed samples can be revealed through sequential milling. Furthermore, following TEM lamella preparation, the integration of a STEM detector into FIB-SEM systems makes it possible to obtain TEM-like images directly within a SEM. Consequently, the combination of sample preparation, high-resolution imaging, and elemental analysis via an integrated EDS detector within a single platform provides laboratories with a highly efficient and practical workflow.

Revisiting the human umbilical cord. Unique cells in a surprisingly fibrous stroma

Alp Can

Ankara University, School of Medicine, Department of Histology and Embryology, Laboratory for Stem Cells and Reproductive Cell Biology

The human umbilical cord (UC), often considered a passive conduit, harbors complex and dynamic tissue compartments with structural and functional relevance to fetal development and maternal–fetal exchange. In a series of complementary studies, we investigated the cellular architecture and molecular signaling within both the epithelial and stromal components of the UC, as well as their alterations under pathological conditions such as preeclampsia (PE). Contrary to the longstanding assumption of a single-layered surface lining, the UC epithelium (UCE) exhibited a surprising degree of plasticity. High-resolution imaging revealed multilayered arrangements anchored to a well-developed basement membrane, with tight intercellular junctions, stratification-specific protein expression, and features suggestive of terminal differentiation. These findings imply that the UCE adapts structurally to mechanical and chemical stimuli in utero and may participate in solute transport between the amniotic fluid and fetal circulation. In the stromal compartment, we identified a distinct population of telocyte-like cells (TLCs) within Wharton's jelly. These cells, characterized by thin, elongated processes and a unique immunophenotype, were spatially associated with multipotent stromal cells (MSCs), suggesting a supportive or regulatory role in the stromal microenvironment. Their presence adds a new dimension to the understanding of cellular heterogeneity and intercellular communication in fetal tissues. Finally, in UC samples from PE pregnancies, we observed notable alterations in vessels and a reduction in VEGFR-2 mRNA expression in stromal regions, despite relatively preserved protein levels. MSCs and their exosomes derived from PE cases demonstrated impaired angiogenic capacity, likely contributing to the vascular dysfunction associated with the disease. Together, these studies provide a comprehensive view of the structural, cellular, and functional complexity of the UC. They highlight the tissue's potential involvement in fetal adaptation, stem cell niches, and pathological disruptions during pregnancy. (Funded by Ankara University Scientific Research Fund TSG-2022-2545, TYL-2024-3343 to AC, TUBITAK 121S821 to FTC).

Keywords: Umbilical cord, Stroma, Epithelium, Multipotent stromal cells, Pre-eclampsia

From nucleolar morphology to phase separation in the cell nucleus

Pavel Hozak

Institute of Molecular Genetics ASCR, v.v.i. Prague, Czechia

Processes such as gene expression or DNA repair are compartmentalized within eukaryotic nucleus, and nuclear environment contains dynamic membrane-less sub-compartments whose formation is prevalently driven by phase separation. It Apparently, formation of phase boundaries provides the surface for spatiotemporal control contributing to the high-rate kinetics of crucial processes such as transcription, ribosome maturation, splicing. I will briefly recapitulate the history of my research and devote a majority of my talk to recent findings from our Prague laboratory. findings We discovered the Nuclear Lipid Islets (NLIs) – globular ~100 nm structures containing PI(4,5)P2 (PIP2) at their periphery which associate with key transcription factors, and showed that NLIs are crucial for efficient Polymerase II transcription. To decipher whether the NLIs surface recruits a transcription regulatory proteins through PIP2 molecules in their surface, we employed a proteomic approach based on differential quantitative mass in combination with super-resolution microscopy. We identified more than 300 NLIs-associated proteins belonging to gene expression (53%) and pre-mRNA splicing (33%). Super-resolution microscopy confirmed that some candidate proteins form foci in nucleoplasm and associate with sub-population of NLIs. Further, our bioinformatical analysis of putative NLIs proteins revealed that majority of them contain Intrinsically Disordered Regions (IDRs). IDRs are known features of proteins undergoing phase separation under in vivo and in vitro conditions. Moreover, we found that the vast majority of these proteins contain K/R rich motifs, which were previously shown as recognition sites for phosphoinositide (PIPs) binding. We hypothesize that NLIs may serve as a structural platform integrating RNA Polymerase II transcription and pre-mRNA splicing by attracting proteins which are prone to form liquid-like particles.

Acknowledgements: Czech-BioImaging projects (LM2018129 and LM2023050, funded by MEYS CR).

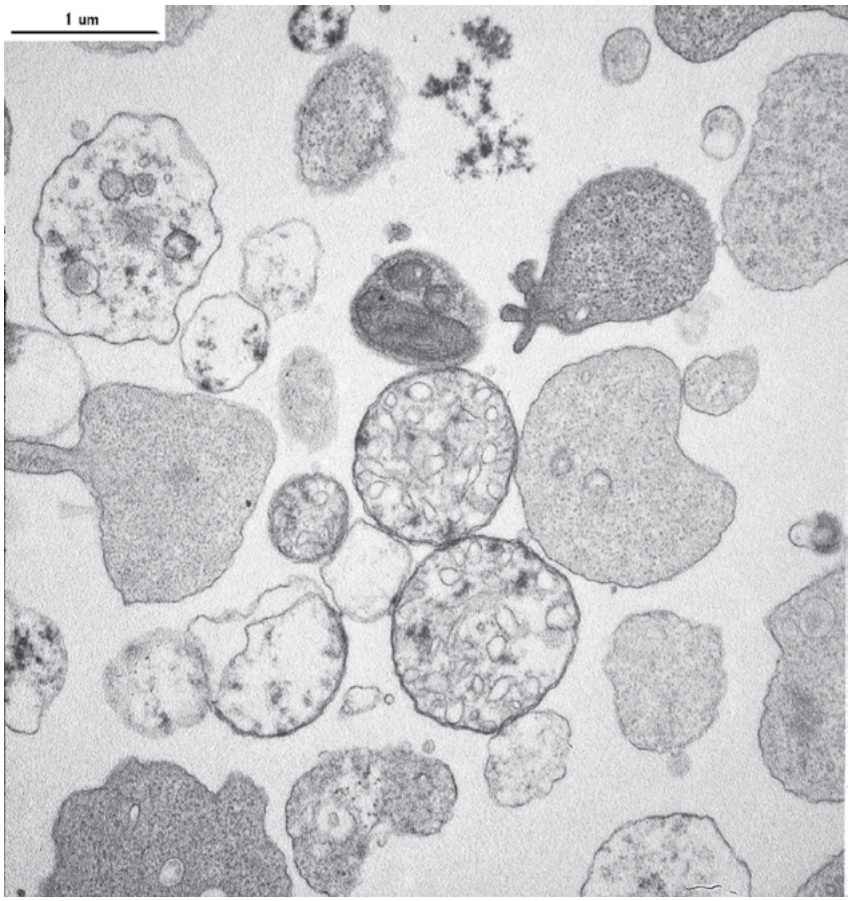
Keywords: cell nucleus, compartmentalization, phase separation, gene expression, epigenetics, microscopy

Deciphering the secrets of extracellular vesicles or the limits of classical TEM examinations

Agnes Kittel

HUN-REN Institute of Experimental Medicine, Budapest, Hungary

The discovery of extracellular vesicles (EV) has helped to explain many phenomena. However, despite the fact that more and more dedicated scientists around the world are working on this research field, and new results are published almost daily in several journals, many secrets of these small particles are still unexplored. The heterogeneity of EVs, surrounded by a double lipid layer, is amazingly high, even when they are emitted by a single cell. Their size range ranges from 40 nm to 5 µM in diameter, with significant differences in their intercellular origin and content. The lack of standardized methods for isolating and analyzing extracellular particles is one of the main obstacles to the fact that EVs are still not widely used as diagnostic or therapeutic tools. It is not even easy to decide on which criterion we are trying to separate them by. Initially, they were divided into three groups based on their size, and the researchers tried to collect the appropriate fractions using filtration and centrifugation procedures. However, the reproducibility of experimental results was often a challenge even in the case of cell lines. There is not even a guarantee that two particles of the same size are identical in terms of molecular composition. Even recently we don't know yet which mechanisms are behind this. And it is only one question of many. More than half a century ago, transmission electron microscopy proved the presence of these mysterious vesicles and helped distinguish them from cell debris. While none of the latest, highly sophisticated electron microscopy techniques are sufficient on their own, the use of EM in EV research has survived to this day and will continue to be an indispensable tool for truly understanding the nature of these long-unknown and later misunderstood particles, and this will eventually lead to their use in many areas of medicine.



Microparticles derived from U937 cells.

Exosomes: Tiny Packages, Transformative Potential: Biogenesis and Their Role in Medicine

H. Seda Vatansever [1,2]

[1] Department of Histology and Embryology, School of Medicine, Manisa Celal Bayar University, Manisa, Turkiye

[2] DESAM Institute, Near East University, Mersin, Turkiye

Exosomes are nanosized extracellular vesicles secreted by various cell types that play a fundamental role in intercellular communication, transport of biomolecules, and regulation of physiological and pathological processes. Structurally, they are characterized by a lipid bilayer membrane enriched with transmembrane proteins (CD63, CD81, CD9), heat shock proteins, and other molecules that protect and deliver diverse cargos, including proteins, lipids, cytokines, and coding and non-coding RNAs. Exosome biogenesis occurs through ESCRT-dependent, ESCRT-independent pathways, or direct plasma membrane budding, and their contents vary according to cell type and physiological state. Once released, exosomes enter target cells via diffusion, endocytosis, or receptor-mediated mechanisms, thereby influencing immune regulation, angiogenesis, tissue homeostasis, and regeneration.

Due to their ability to encapsulate and transfer functional ncRNAs and other biologically active molecules, exosomes have emerged as promising candidates in regenerative medicine, oncology, and drug delivery systems. Their unique membrane composition and natural targeting abilities provide advantages over synthetic nanoparticles, including high biocompatibility, stability, and reduced immunogenicity. Furthermore, exosomes have been identified as highly sensitive and specific biomarkers in cancer, neurodegenerative, cardiovascular, and infectious diseases, offering superior diagnostic potential compared to conventional serum-based markers.

Despite these advantages, challenges remain regarding large-scale production, purification, and standardization for clinical applications. Critical knowledge gaps persist in understanding their exact mechanisms of action and role in disease progression. Nevertheless, the intrinsic properties of exosomes position them as powerful tools for next-generation cell-free therapies, targeted drug delivery, and clinical diagnostics. Addressing current technological limitations will be essential to fully realize their therapeutic potential and translate exosome-based strategies into tangible clinical benefits. Therefore, a comprehensive understanding of the general characteristics, molecular contents, and condition-dependent biogenesis of exosomes is essential prior to their clinical application in medicine.

Live super-resolution imaging of programmed cell death

Barbara Conradt

Department of Cell and Developmental Biology, University College London, London, United Kingdom

During the development of the nematode *Caenorhabditis elegans*, 131 cells reproducibly die, many through apoptosis. This reproducible pattern of programmed cell death allows the analysis of this process at single cell resolution. We have taken advantage of this and investigated the role of mitochondria using live super resolution imaging. Our results suggest that mitochondrial density in a cell programmed to die correlates with the time it takes that cell to die. In addition, we found that cells programmed to die inherit fewer and smaller mitochondria than their surviving sister cells. Finally, disrupting unequal mitochondrial segregation during cell divisions that give rise to a programmed death impact the ability of the daughter programmed to die to actually die. We are currently investigating the mechanisms through which mitochondria are unequally segregated and through which mitochondria impact programmed cell death.

Keywords: mitochondria, programmed cell death, asymmetric cell division, C. elegans, live super resolution imaging

Can we increase the therapy response of brain tumors by epigenetic interventions?

Tugba Bagci-Onder

Koç University School of Medicine

Gliomas are common and aggressive brain tumors. Standard-of-care for high-grade gliomas (glioblastoma-GBM), or low-grade gliomas (LGG), includes surgery, radiotherapy and chemotherapy. Despite the recent refinements in these therapeutic approaches, the mean patient survival remains extremely low. Therefore, there is an unmet need for developing more effective and novel therapies.

A mechanism of therapy resistance is transcriptional dysregulation of cell death and survival-related genes through epigenetic modifications that occur through the action of chromatin modifying proteins (CMPs), such as histone deacetylases, histone demethylases, bromodomain proteins, among many others. To interrogate the relationship between therapy response and chromatin modifications, we undertake loss-of-function screens that are based on genetic or chemical ablation of the CMP function. In our recent work, we targeted therapy-resistant GBMs as well as Isocitrate Dehydrogenase 1 (IDH1)-mutant LGGs. For the therapy-resistant models, we generated Temozolomide- or Radiotherapy-resistant cell lines; while for *IDH1*-mutant gliomas, we utilized primary lines carrying a point mutation (R132H) in the *IDH1* gene. Using a combination of CRISPR/Cas9-based genetic approach and chemical approach concurrently, we aim to identify major epigenetic mechanisms playing a role in gliomas. In this talk, we will highlight our recently identified molecular mechanisms behind the selective epigenetic vulnerabilities of therapy-resistant GBMs and *IDH1*-mutant gliomas.

Hydra Bio Plasma-FIB Technologies for Multidisciplinary Research

Meltem Sezen Ozkoc[1]

[1]Thermo Fisher Scientific, Eindhoven, Netherlands

AIM: This study aims to evaluate the Thermo Scientific™ Hydra Bio™ Plasma-FIB (PFIB) for high-resolution volumetric imaging of frozen-hydrated and plastic-embedded biological samples and its effectiveness in cryo-electron tomography workflows.

MATERIALS AND METHODS: The Hydra Bio PFIB is used for imaging various biological samples. Cryo-fixation techniques minimize artifacts associated with traditional volume electron microscopy (EM) sample preparation. The system's ability to switch between plasma source ions (xenon, argon, oxygen, and nitrogen) optimizes milling efficiency and surface quality. Automated serial milling and imaging are conducted using Cryo Auto Slice & View Software, and the Spin Mill Bio Method is applied for large-area planar milling. High-quality cryo-lamellae are prepared using the EasyLift Cryo Lift-Out System and AutoTEM Cryo Software. Correlative light and electron microscopy (CLEM) workflows are integrated for precise targeting of regions of interest.

RESULTS: The Hydra Bio PFIB achieves high-resolution 3D imaging at cryogenic temperatures with minimal charging artifacts. The multi-ion plasma source facilitates efficient milling and smooth surface preparation. Automated serial milling and imaging provide high-resolution data for both cryogenic and plastic-embedded samples. The Spin Mill Bio Method enables extensive planar milling, revealing large sample areas with slice thicknesses as small as 5 nm. High-quality cryo-lamellae are successfully prepared, and the integrated CLEM workflow allows precise targeting of regions of interest.

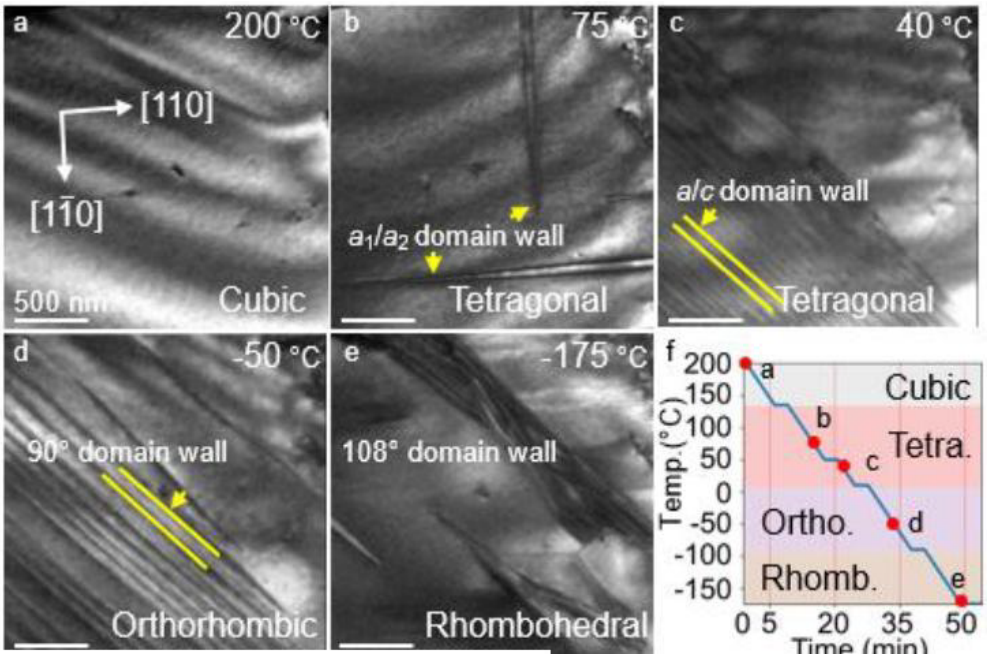
CONCLUSION: The Thermo Scientific™ Hydra Bio™ Plasma-FIB (PFIB) is a versatile tool for multidisciplinary research, offering advanced capabilities for high-resolution volumetric imaging and cryo-electron tomography. Its integration of automation and cryo-technologies, along with multi-ion plasma sources, enhances sample preparation and imaging efficiency and quality, applicable across various fields.

Cryogenic TEM Sample Holder and MEMS-Chips Development for In Situ Cooling, Heating and Biasing Applications

David Westmoreland[1], Yevheniy Pivak[1], Mia Andersen[1], Tianshu Jiang[2], Andres Alvarez[1], Gijs van der Gugten[1], Vasilis Papadimitriou[1], Christian Deen-van Rossum[1], Eva Bladt[1], Leopoldo Molina-Luna[2]

[1] Denssolutions, Delft, The Netherlands
[2] Technische Universität Darmstadt, Germany

Recent developments in the cryogenic scanning transmission electron microscopy (cryo-STEM) have sparked significant interest from the quantum materials community [1]. Cryo-STEM is becoming an indispensable tool to visualize phase transitions at the atomic scale with improved stability [2-4]. The reduced sample drift comes from the advancements in the cryo-STEM sample holders [5] and the usage of the microelectromechanical systems (MEMS)-based chips [6] which opens up the possibility to locally and continuously change the temperature of the sample in a wide temperature range and, at the same time to measure its electrical response. The ability to understand the structure, electronic and transport properties of materials under an applied thermal and/or electrical stimulus at low temperatures enable applications in the field of quantum materials like superconductors and topological insulators, charge ordering, metal to insulator transitions, magnetic materials, ferroelectrics and more. In this talk I will present a number of application examples with Focused Ion beam (FIB) lamellas on a variety of samples; showcasing a new emerging field from our customer base where it is possible to combine high resolution EM with intermediate cooling temperatures and biasing.



In situ cooling TEM characterization of all four phases of BTO. A-E: BF TEM images obtained along [001] zone axis of the BTO sample. The scale bars are 500 nm; F: the plot shows temperature (T) vs. time, with points A-E highlighted at different temperatures, corresponding to BF-TEM images labeled A-E. T: Tetragonal; R: rhombohedral phases; O: orthorhombic; TEM: transmission electron microscopy; BTO: BaTiO3; BF: bright-field; DW: domain wall.

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Intravital imaging of lymphocytes using multi-photon microscopy

Naoto Kawakami

Institute of Clinical Neuroimmunology, University Hospital LMU and Biomedical Center, Faculty of Medicine, LMU, Planegg-Martinsried, Germany

Lymphocytes rarely infiltrate the central nervous system (CNS) because it is secluded by the blood-brain barrier (BBB). However, under specific conditions, lymphocytes, especially T cells which are autoreactive to CNS-specific antigen, can pass the BBB, infiltrate the CNS, become activated, and induce local inflammation, which is characteristic of multiple sclerosis (MS), a human autoimmune disease. We use intravital multi-photon microscopy to visualize lymphocyte infiltration into the CNS in experimental autoimmune encephalomyelitis (EAE), an animal model for MS. To track the T cells in vivo, we genetically labeled them with green fluorescent protein (GFP) or activation sensors, such as calcium-sensing protein Twitch and GFP-conjugated NFAT, using retroviral gene transfer.

We demonstrated that autoreactive T cells were stimulated by the microbiota in the ileal lamina propria of the small intestine. This stimulation triggered phenotypic changes in the T cells and their migration to the CNS. Upon arrival, the T cells appeared in the blood vessels in the leptomeninges. The T cells firmly attached to the inner surface of the blood vessels and migrated, preferably against blood flow. Then, the T cells extravasated through the BBB, a process that takes a few minutes, and infiltrated the CNS, where they interacted with local antigen-presenting cells. As a result of this interaction, the T cells become activated as visualized by activation sensors. Importantly, inhibiting T cell infiltration or activation can be used as a therapeutic target. For example, we demonstrated that inhibiting integrin alpha4 on T cells diminished their adhesion to endothelial cells, thereby preventing their CNS infiltration and subsequent inflammation. In summary, we successfully visualized T cell infiltration into the CNS and local activation using intravital multi-photon microscopy. The obtained results deepen our understanding of the mechanisms of T cell infiltration and can be used to develop new therapies.

Keywords: multi-photon microscopy, intravital imaging, T cells

Microscopy in Transition: From Optical Lenses to Intelligent Algorithms

Serçin Karahüseyinoğlu

Department of Histology & Embryology, Koc University School of Medicine, Istanbul, Turkiye; Cellular and Molecular Imaging Core, KUTTAM (Koc University Center for Translational Medicine), Istanbul, Turkiye

INTRODUCTION: Microscopy has progressed from the simple optical systems to advanced, intelligent platforms that combine high-end optics with computational algorithms. Foundational improvements were followed by the advent of confocal, multiphoton, and light-sheet systems—for resolution, depth, and speed while reducing phototoxicity. Artificial intelligence (AI) and deep learning approaches transform microscopy into a tool not only for visualization but also for real-time, adaptive interpretation of complex biological samples. This presentation focuses on the application of these technologies to embryology, stem cell biology, and whole-organ imaging in multiple model systems.

MATERIALS and METHODS: We employed a range of advanced modalities including confocal microscopy, multiphoton microscopy and light-sheet fluorescence microscopy for volumetric imaging. AI-assisted post-processing tools were applied for denoising, 3D reconstruction, and feature segmentation. Biological specimens included:(i)mouse, human, and zebrafish embryos and gametes (fixed and live);(ii) human mesenchymal stem cells under various differentiation and labeling conditions;(iii)whole-organ preparations of mouse liver and kidney;(iv) whole-organism samples of zebrafish larvae and mid-gestation mouse fetuses. Sample preparation protocols included tissue clearing (e.g., CUBIC and iDISCO+), fluorescent labeling of cytoskeletal and nuclear components, and embryo whole mounting in low-scattering media optimized for each modality.

RESULTS: Advanced imaging approaches enabled detailed visualization of cytoskeletal architecture, cell-cell interactions, and nuclear organization in gametes and embryos across species with high-resolution snapshots of live and fixed samples, 3D imaging of intact tissues and whole embryos. AI-enhanced segmentation distinguished subtle cytoplasmic and nuclear patterns. In organ-level imaging, vascular and epithelial structures in organs were reconstructed volumetrically. The results demonstrate the synergy between cutting-edge optics and intelligent algorithms in modern microscopy workflows. CONCLUSIONS: When paired with intelligent algorithms advanced optical systems enable unprecedented insights into both cellular and anatomical structures across scales. These technologies allow for deep, high-resolution imaging and are particularly powerful in developmental biology, stem cell research, and organ-level mapping.

Keywords: advanced microscopy, deep learning, cutting-edge optics

Next-Gen Spinning Disk Microscopy by Evident: Precision Imaging for Living Cells

Rahul Kumar

Evident Scientific Sales Specialist Middle East - Turkey - Africa

Live-cell imaging presents unique challenges, requiring high-speed, high-resolution optical systems that minimize phototoxicity and photobleaching while maintaining cellular viability over extended imaging periods. Spinning disk confocal microscopy has become a preferred technique for such applications due to its ability to rapidly acquire optically sectioned images with reduced light exposure. In this study, we assess the capabilities of the **Evident Spinning Disk Microscopy system**, a next-generation imaging platform designed specifically for dynamic biological systems.

The system employs a high-density Nipkow disk with microlens-enhanced pinholes to achieve simultaneous confocal excitation and detection at multiple points across the field of view. This architecture enables rapid image acquisition rates (exceeding 100 frames per second) while significantly reducing the illumination dose per focal plane. Combined with high-sensitivity sCMOS cameras and precision Z-motor control, the Evident system supports high-speed 3D imaging with minimal photodamage—an essential feature for monitoring sensitive processes in living cells.

We demonstrate the utility of the system across a range of live-cell imaging applications, including tracking intracellular organelle transport, observing actin and microtubule dynamics, and monitoring mitotic progression in mammalian cells. The system's integrated environmental chamber allows for precise control of temperature, humidity, and CO_2 levels, supporting long-term time-lapse experiments under physiological conditions.

Furthermore, the platform's compatibility with advanced fluorescent probes and multi-channel acquisition protocols enables multiplexed imaging of cellular structures and signaling pathways in real time. Quantitative image analysis confirms the system's ability to deliver consistent spatial and temporal resolution across extended imaging sessions.

Our evaluation highlights the Evident Spinning Disk Microscopy system as a powerful and versatile tool for modern cell biology. Its combination of speed, sensitivity, and low phototoxicity makes it particularly well-suited for applications requiring live-cell observation over time, including studies in developmental biology, intracellular trafficking, drug response assays, and high-content screening. This system represents a significant advancement in live-cell imaging technology, bridging the gap between high-resolution confocal imaging and the practical demands of real-time biological observation.

Redefining 2D/3D Imaging: Introducing the New 120kV Transmission Electron Microscope (TEM)

Gaurav Sharma

Materials and Structural Analysis, Analytical Instruments Group, Thermo Fisher Scientific

Achtseweg Noord 5651 GG Eindhoven, The Netherlands

The advancement of imaging technologies has always been pivotal in scientific research, particularly in the fields of materials science, biology, and nanotechnology. This conference presentation introduces the new 120kV Transmission Electron Microscope (TEM), a state-of-the-art instrument designed to redefine the capabilities of both 2D and 3D imaging.

The new 120kV TEM offers unprecedented resolution and clarity, enabling researchers to visualize structures at the atomic level with enhanced precision. Its innovative design incorporates advanced electron optics and detectors, which significantly improve image quality and reduce aberrations. Additionally, the TEM's versatile imaging modes facilitate seamless transitions between 2D and 3D imaging, providing comprehensive insights into the spatial arrangement and morphology of samples.

Key features of the new 120kV TEM include:

1. **High-Resolution Imaging**: Capable of achieving high-resolution images, allowing for detailed visualization of fine structures at the nanoscale.
2. **Advanced Electron Optics**: Features advanced electron optics to minimize aberrations and enhance image quality, ensuring clear and precise imaging.
3. **3D Imaging Capabilities**: Equipped with tomography capabilities for three-dimensional reconstruction of sample structures, providing in-depth analysis of complex morphologies.
4. **Automated Functions**: Includes automated alignment, focusing, and data acquisition to streamline the imaging process, improve efficiency, and ensure reproducibility.
5. **User-Friendly Interface**: Designed with an intuitive user interface that simplifies operation, making it accessible to both novice and experienced users.

This presentation will delve into the technical specifications, operational capabilities, and potential applications of the new 120kV TEM. Case studies demonstrating its impact on various research domains will be showcased, highlighting how this innovative tool is set to transform imaging practices and accelerate scientific discoveries.

Join us as we explore the future of imaging technology and unveil the transformative potential of the new 120kV TEM.

Biomimetic Bioprinting for Tissue/Organ Engineering

Bahattin Koç

Sabanci University, Faculty of Engineering and Natural Sciences, Department of Manufacturing Engineering Türkiye

Bioprinting is an advanced method in tissue and organ engineering that constructs 3D living structures by depositing cells and biomaterials layer by layer. Unlike traditional techniques, it relies solely on live cells, biomolecules, and biomaterials to replicate complex biological architectures. This presentation will cover biomimetic 3D bioprinting, bioprinters, and bioinks, along with digital tissue modeling, bioink preparation, and cell printing protocols. Key applications and current challenges in organ bioprinting will also be discussed.

Natural and Sustainable Polymers of Bacterial Origin and their Biomedical Applications

Ipsita Roy

School of Chemical, Materials, Biological Engineering,

Faculty of Engineering, University of Sheffield, UK

In this work we have focused on the production and use of bacteria-derived sustainable biomaterials for use in biomedical applications. Two main types of biomaterials have been focused on, including Polyhydroxyalkanoates (PHAs)[1] and bacterial cellulose (BC)[2]. PHAs are polyesters produced by a range of bacteria including *Ralstonia eutropha*, *Psuedomonas sp.*and *Bacillus subtilis*. These polymers are biodegradable in the soil and in the sea. In addition, they are also resorbable in the human body and are highly biocompatible. Hence the PHAs can be used for biomedical applications such as the development of scaffolds for hard and soft tissue engineering, medical devices, and drug delivery. BC can also be produced by a range of bacteria including *Gluconobacter xylinus and Sarcinia ventriculi.* BC is also a green polymer, is sustainable and degradable in the soil. It is also highy biocompatible and can be used in biomedical applications.

Polyhydroxyalkanaotes are polyesters with monomer chain length ranging between C_4 - C_{16}. They are divided in to two main types, short chain length PHAs (scl-PHAs) with monomer chain length C_4-C_5 and medium chain length PHAs (mcl-PHAs) with monomer chain length C_6-C_{16}.The scl-PHAs are normally hard and brittle whereas the mcl-PHAs are soft and elastomeric in nature. Hence, we have mainly used the scl-PHA, Poly(3-hydroxybutyrate), P(3HB), for bone tissue engineering[3], drug delivery[4] and medical devices development such as coronary artery stents, and the mcl-PHAs for cardiac, nerve, pancreas, kidney and skin regeneration. For bone tissue engineering we have used neat P(3HB) and composites of P(3HB) with Bioglass®[3], hydroxyapatite[8] and carbon-based materials[7]. The mcl-PHAs have been used for the development of cardiac patches[6], nerve guidance conduits[5], wound healing patch, bioartificial pancreas and bioartificial kidney. Processing techniques used include additive manufacturing, electrospinning and melt electrowriting.

Bacterial cellulose has also been produced under static culture conditions using *G. xylinus*. This is a highly nano-fibrillated structure and hence is an excellent substrate for cell attachment and growth. We have surface modified bacterial cellulose to create antibacterial bacterial cellulose[9]. We have also used BC as a filler for P(3HB) based composites since BC is one of the stiffest known materials. In addition, we have electrospun BC for a range of applications.

In conclusion, we have successfully used bacteria-derived sustainable biobased materials for a variety of biomedical applications. Both PHAs and bacterial cellulose have a lot of potential in the future as sustainable biomedical materials of choice.

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Morphological evaluation of biomolecule-conjugated nanomedicine platforms

Ozgul Gok [2]

[1] Department of Biomedical Engineering, Faculty of Engineering and Natural Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey

[2] Biomedical Engineering Program, Graduate School of Natural and Applied Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey

Nanomedicine platforms, when functionalized with biomolecules, present a promising tool in translational medicine and offer a powerful strategy for targeted drug delivery and enhanced therapeutic efficacy. This abstract focuses on the morphological evaluation of various bioactive-nanoparticles to elucidate the critical relationships between their physical properties and their potential for therapeutic applications. PEG (Poly ethylene glycol)-based nanoparticles were functionalized with various reactive groups, which later on utilized as either biocompatible, hydrophilic and non-immunogenic carriers for controlled drug delivery or renewable sensor surfaces with improved anti-biofouling and detection specificity. For the former one, a novel antioxidant (α-lipoic acid)-containing drug molecule (LA3-MA) was successfully synthesized and incorporated into PEG-based nanogels via the UV gelation with 5, 10 and 20% feed ratio by weight and drug-loaded nanogels were obtained to bear drug encapsulation efficiency as 76.21, 85.53 and 87.94, respectively. To target the atherosclerotic region, anti-VCAM1 antibodies were conjugated on the surface of amine-functionalized nanogel. Moreover, PEG-based nanogels were synthesized as 2% amine containing versions, which were used to conjugate Cy5 as imaging agent (400 µg/mL) and anti-VCAM-1 antibody as 1-2 in average MABs per nanoparticle. It was demonstrated that anti-VCAM1 antibody-bounded nanogels reduce oxidative stress 2.6 times more in the 2 mM LA containing nanogel group than the 2 mM free LA group for LPS-activated HUVEC cells, as a model for inflammation-based atherosclerotic region. These nanogels were also decorated with free thiol groups, through which they were immobilized on gold surfaces that mimicked gold-coated mass sensor platforms. Nanoparticles were shown to result in the preparation of a monolayer and smooth coating of 80–120 nm thickness. Cysteine-modified NTS(8–13) peptide was conjugated to thiolated NP as 203.2 µg/mL with reversible disulfide bonds and its cleavage with a reducing agent such as dithiothreitol (DTT) restores the NP-immobilized gold surface for at least two cycles.

Theranostics

Bukem Tanoren

Faculty of Engineering and Natural Sciences, Department of Natural Sciences Acibadem University, Istanbul, Turkiye

Theranostics is a portmanteau of therapeutics and diagnostics. Recently, nanoplatforms are designed to codeliver imaging and therapy components for the diagnosis and treatment of many diseases including cardiovascular diseases, diabetes, cancer, bacterial infections, neuro-disease, etc. It is important to mention that nanoparticles have considerably improved the diagnostics and therapeutics of various diseases due to small size, ease of functionalization, enhanced drug loading (due to large surface to volume ratio), effortless penetration abilities, and improved retention inside target tissue. Carbon quantum dots (CQDs) are carbon-based biocompatible quantum dots that have low toxicity, are more soluble in water, have broad application areas, besides, modification of their surfaces can be performed easily.

We present a new CQD synthesis method with cost-effective reactants. Besides, there is a definitive indication (bubble) due to the reaction between sulphuric acid and pure acetone at high temperatures for CQD production, therefore, the developed method's name is "Hot Bubble Synthesis" (HBBBS). With respect to size, it is generally agreed that nanoparticles of hydrodynamic diameter 10–100 nm are pharmacokinetically optimal for in vivo applications. Nanoparticles smaller than 10 nm are subject to tissue extravasation and renal clearance, whereas those larger than 100 nm are quickly opsonized and eliminated from the circulation via the reticuloendothelial system. With HBBBS, hydrodynamic radius of 10–30 nm is obtained and CQDs with surface modifications are being tested for their potential as sensors, imaging agents, therapeutic agents, and theranostic agents in biological environments.

Keywords: Carbon nanostructures, quantum dots, reaction indication, carbon quantum dots

Morphological and epigenetic outcomes in a mouse model of Assisted Reproductive Technologies

Marisa S. Bartolomei

University of Pennsylvania School of Medicine, Philadelphia, PA, USA

Assisted Reproductive Technologies (ART) have enabled many infertile couples to achieve pregnancy. While largely considered safe, ART procedures are associated placenta abnormalities and occasional adverse offspring outcomes. We have used a validated mouse model that mimics human IVF outcomes to investigate the etiology of these adverse effects. We find that each independent ART intervention is additive with respect to abnormal placental development and fetal outcomes, with embryo culture proving the most detrimental. In vitro fertilization combined with trophoblast biopsy for preimplantation genetic testing results in placental overgrowth and vascular defects together with placental and embryonic transcriptomic and DNA methylation changes relative to naturally conceived offspring. We propose that reducing the number of ART procedures and improvement to embryo culture will mitigate adverse ART outcomes.

Pushing the Boundaries of Developmental Biology: A Technological Tour de Force in Creating True Interspecies Hybrids with Both a Hybrid Genome and Hybrid Cytoplasm

Leyla Sati

Department of Histology and Embryology, Akdeniz University School of Medicine, Antalya, Turkey

The creation of viable interspecies chimeras has long been a challenge in developmental biology, hindered by incompatibilities between nuclear and cytoplasmic components. Here, we present an innovative approach that produces true interspecies hybrids possessing both a hybrid genome and hybrid cytoplasm, enabling unprecedented exploration of cross-species developmental compatibility. By combining pronuclear transplantation with advanced micromanipulation techniques, we introduced nuclear genomes from one species into enucleated zygotes of another, while simultaneously retaining a mixture of both parental cytoplasms from two *Mus* species, *Mus musculus domesticus* and *Mus spretus*, to generate and fuse two single-pronucleus hemizygotes.

The results indicated that *spr*M/*dom*P/hybridC embryos containing both maternal and paternal cytoplasmic components remained viable, whereas those with the same hybrid genome restricted to maternal-only cytoplasm did not. These true hybrids exhibited significantly greater body weight than either parental species, with this size advantage persisting postnatally. Furthermore, they displayed significantly less energy expenditure than both the traditional hybrids and parental species, as determined by quantitative nuclear magnetic resonance spectroscopy and respiratory parameter measurements. Histologically, placentomegaly was observed, characterized by expansion and invasion of vertical columns of spongiotrophoblasts and glycogen cells into the labyrinth zone. There was a striking case of sex ratio distortion in *spr*M/*dom*P interspecies hybrids, yielding exclusively male progeny.

These findings establish a robust experimental platform for elucidating the complex interplay between nuclear and cytoplasmic factors during early development, providing critical insights into the molecular barriers underlying interspecies reproduction. Beyond its basic science implications, this approach offers unique opportunities to investigate cytonuclear incompatibility, hybrid vigor, and the evolutionary boundaries of reproductive isolation. By integrating both genomic and cytoplasmic heritage, this technological breakthrough not only proves the feasibility of generating true interspecies hybrids but also positions them as transformative model systems for advancing developmental, evolutionary, and reproductive biology.

Keywords: Interspecies Hybrids, Dobzhansky-Muller Incompatibilities, Epigenetics, Nuclear Reprogramming.

The Mitochondrial Relay with the Nucleus: Form and Function

Michelangelo Campanella [1,2,3]

[1]William Harvey Research Institute, Queen Mary University of London, EC1M 6BQ UK

[2]Institute Gustave Roussy, 94805, FR

[3]Department of Biomedical Science, University of Padua, 35131, IT

The interplay between mitochondria and the nucleus is essential for maintaining cellular homeostasis, orchestrating stress responses, and regulating metabolic pathways. This communication is inherently bidirectional, involving intricate signaling networks, transcriptional regulators, and metabolic intermediates. Besides dictating cellular fate through the production of energy and initiation of its demise, mitochondria also serve as signalling hubs that influence nuclear gene expression via retrograde signalling1. This process is particularly crucial in response to oxidative stress, fluctuations in nutrients, and mitochondrial dysfunction.

2nd International Microscopy and Spectroscopy Congress In our recent work, we have identified a previously unrecognised class of membrane contact sites between mitochondria and the nucleus, which we term Nucleus-Associated Mitochondria (NAM). These conserved structures, observed across both mammalian and lower eukaryotic systems, represent a fundamental mechanism by which mitochondrial stress is transmitted to the nucleus.

NAM serve as physical and functional platforms for retrograde signalling, enabling precise regulation of nuclear gene expression, epigenetic reprogramming, and metabolic adaptation. They represent, in our belief, a new dimension of organelle communication that is critical for both cellular physiology and pathology.

In this presentation, I will give an overview of our findings on the molecular structure and functional importance of NAM. I will cover their role in enabling effective signal transduction, their emerging significance in disease development and progression, and their potential as biomarkers and therapeutic targets in precision medicine.

Keywords: mitochondrial retrograde signalling, mitochondrial membrane contact sites, nucleus-associated mitochondria, pathogenesis and precision medicine.

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ZBTB proteins polymerize to form distinct cellular condensates

Batu Erman[1], Egemen Erim[2], Eymen Gümüşdil[2]

[1]Department of Molecular Biology and Genetics, Acıbadem University, Istanbul, Turkey

[2]Department of Molecular Biology and Genetics, Boğaziçi University, Istanbul, Turkey

Zinc Finger- Broad complex, Tramtrack and Bric-à-brac (ZBTB) proteins are transcription factors that control important developmental processes. The human genome encodes 49 ZBTB proteins which have N-terminal BTB domains used for protein-protein interactions and C-terminal Zinc Finger DNA Binding domain. BTB domains form obligate homodimers. We recently demonstrated that the structures of the BTB domains are conserved such that different family members can form heterodimers. Structure predictions using Alphafold3 indicate that these BTB domains can form polymeric structures. The prediction of polymer formation directly correlates with the ability of BTB domains to form condensate structures in the cell. We identify a conserved serine containing motif that 20 out of the 49 ZBTB proteins contain, which is responsible for polimer and condensate formation. We discovered that BTB domains that contain this motif can recruit ZBTB proteins that do not contain this motif into their condensates. Moreover, motif containing ZBTB proteins form distinct condensates and exclude other motif containing ZBTB proteins from these condensates. We used confocal microscopy, Fluorescence Recovery After Photobleaching (FRAP) to identify the liquid-like properties of these condensates. We discuss the potential biological function of these cellular condensates formed by ZBTB polymers.

Keywords: ZBTB proteins, Transcription Factors, Condensates, Cellular Compartmentalization

Resolving Subcellular Structure Alterations in Cancer with (Correlative) Light and Electron Microscopy

Nalan Liv

University Medical Center Utrecht, Department of Cell Biology, The Netherlands

Alterations in the biogenesis, function, and interactions of intracellular organelles are hallmarks of diverse pathologies, including cancer. Visualizing these organelles and their crosstalk with high spatio-temporal resolution is essential for understanding their functional regulation. We have developed advanced Correlative Light and Electron Microscopy (CLEM) workflows that integrate the molecular specificity and live-cell capabilities of fluorescence microscopy (FM) with the nanometer-resolution ultrastructure provided by electron microscopy (EM). Our approaches include both 2D on-section CLEM for morpho-functional characterization and 3D live-cell volume CLEM—combining dynamic imaging with large-volume EM (including FAST-EM)—to capture rare and transient inter-organelle interactions in their full 3D ultrastructural context.

Applying these methods to the endo-lysosomal system, we correlate molecular markers, functional readouts (e.g., enzyme activity, pH, calcium content), and single-organelle dynamics with ultrastructural features in a single dataset. In an inducible HER2-positive breast cancer model, our integrated FM–(v)EM approach revealed profound organelle remodeling upon HER2 induction: lysosomes became denser and redistributed toward the cell periphery, mitochondria elongated with altered cristae organization, and the endoplasmic reticulum transitioned from sheet-like to tubular forms. Lipid droplets emerged uniquely in HER2-positive cells, suggesting enhanced lipid biosynthesis. Notably, we observed a marked increase in contact sites between lysosomes and the ER or mitochondria—key hubs for calcium exchange, metabolite transfer, and metabolic adaptation—validated by proximity ligation assays.

These findings demonstrate that HER2-driven cancer cells rewire organelle ultrastructure and inter-organelle communication to support aggressive metabolic phenotypes. Our CLEM and FAST-EM workflows offer unprecedented opportunities to dissect the spatial, temporal, and functional regulation of organelle networks in health and disease, opening new avenues for therapeutic target discovery.

Rewiring of Organelle Ultrastructure and Interactions in HER2-Positive Breast Cancer Revealed through Volume Electron Microscopy

Lakshmi Edakkandiyil[1], Valentina Gomez Mellado[1], Arent Kievits[2], Noa Rijneveld[1], Cecilia De Heus[1], Judith Klumperman[1], Jacob Hoogenbom[2], Nalan Liv[1]

[1]Centre for Molecular Medicine, University Medical Centre, Utrecht, The Netherlands

[2]Technical University, Delft, The Netherlands

Human Epidermal growth Receptor 2 (HER2) positive cancer cells are known to exploit intracellular pathways, particularly the endo-lysosomal system and the mitochondrial metabolism, to overcome metabolic constraints. While elevated lysosomal markers and alterations in mitochondrial function have been observed in HER2-positive breast cancer cells, the precise cellular mechanisms linking these changes to cancer progression remain unclear. To address this gap, we engineered an inducible HER2 expression model in MCF-7 breast cancer cells, originally HER2-negative, and employed fluorescence microscopy (FM), (immuno) electron microscopy (EM) and FAST-EM as an advanced volume electron microscopy (vEM) technique, to investigate subcellular alterations in organelle ultrastructure and their implications for HER2-positive cancer biology. FAST-EM is a cutting-edge method enabling high-throughput, large-volume electron microscopy with high-resolution resolution and unparalleled efficiency. This novel approach allowed us to generate comprehensive three-dimensional datasets of cellular ultrastructure, significantly enhancing our ability to visualize and quantify the intricate interplay between organelles in HER2-positive breast cancer models.

Our results reveal significant structural and functional changes in endo-lysosomal organelles upon HER2 induction. Using FAST-EM and Transmission Electron Microscopy (TEM), we observed denser lysosomes dispersed towards the cell periphery, indicative of altered lysosomal dynamics. In addition to endo-lysosomes, 2D and 3D ultrastructural analyses showed significant mitochondrial elongation in HER2-positive cells. By integrating FAST-EM with computational models like MitoNet, we identified precise alterations in mitochondrial architecture and confirmed broader morphological changes in the cellular landscape. Notably, the contact sites between lysosomes and other organelles, such as the endoplasmic reticulum (ER) and mitochondria, were markedly increased. These observations overall emphasized the value of FAST-EM in capturing dynamic inter-organelle interactions and structural reorganization, providing insights that were previously inaccessible through conventional methodologies. In conclusion, our study highlights how HER2 oncogene induction reprograms organelle morphology and enhances inter-organelle interactions, contributing to the aggressive phenotype of HER2-positive breast cancer.

Keywords: Volume EM, ImmunoEM, Organelle ultrastructure, Breast Cancer, FAST EM, MitoNET

Visualization of EV Biogenesis and Secretion Using Advanced Light and Electron Microscopy

Zahra Elly Soltani

Utrecht University, Cell Biology The Netherlands

Vascular Endothelial Growth Factor A (VEGFA) is a key angiogenic factor secreted in response to hypoxic conditions, stimulating blood vessel formation and restoring tissue homeostasis. In cancer, however, its secretion is associated with abnormal and disorganized vasculature. Interestingly, VEGFA alternative splicing isoform VEGFA-189 is more prevalent in cancer, while VEGFA-165 is more common in non-cancerous states. While VEGFA was long believed to follow the conventional secretory pathway, recent findings reveal its association with the surface of extracellular vesicles (EVs), significantly enhancing its stability and potential for intercellular signaling.

Despite this discovery, the mechanisms underlying VEGFA's sorting onto EVs, and how this differs between isoforms, remain poorly understood, largely due to the technical challenges of imaging nanoscale vesicles with high molecular complexity. To address this, we employed a combination of advanced microscopy techniques, including electron microscopy (EM) such as immune-EM and Cryo-EM and state-of-the-art fluorescence microscopy approaches such as direct Stochastic Optical Reconstruction Microscopy (dSTORM) and expansion microscopy (ExM). These tools allowed us to visualize EV populations from colorectal cancer (CRC) cell lines at nanoscale resolution and identify the localization of multiple protein markers simultaneously.

Our results reveal distinct sorting mechanisms for VEGFA isoforms across EV subpopulations marked by different tetraspanins. Together with live-imaging analysis using TIRF microscopy, these findings indicate that the VEGFA-165 isoform predominantly follows the conventional secretory pathway and is enriched on larger EVs, likely originating from plasma membrane budding. In contrast, the VEGFA-189 isoform is primarily associated with smaller EVs derived from the endo-lysosomal pathway.

These findings suggest a differential role of VEGFA-isoforms in EV-mediated angiogenesis and open new avenues for targeted therapeutic strategies.

By leveraging advanced microscopy technologies, we were able to uncover intricate subcellular trafficking routes, underscoring the power of advanced imaging in decoding EV biology and its relevance to cancer progression.

Investigation of Mechanism of Action of Newly Developed Wide Spectrum Peptide Antibiotics by Electron Microscopy

Tanıl Kocagöz

Acibadem University, Faculty of Medicine, Department of Medical Microbiology, Türkiye

Antibiotic resistance became a worldwide problem in the last few decades. Every year, approximately five million deaths occur due to antimicrobial resistant bacteria. Inspired by natural antimicrobial peptides, we have developed protease resistant peptide antibiotics which have both high antibacterial and antifungal activity. We have investigated their effects on bacterial ultrastructure by transmission (TEM) and scanning electron microscopy (SEM) to understand their mechanisms of action. The morphology of E. coli cells changed after treatment with D-TN6, one of the most active protease resistant peptide antibiotics that we have developed. We have observed small pits, blisters and balloon-like structures by SEM. TEM analysis revealed thickening of the cell membrane and degenerated morphology with a discontinuous appearance of membranes. We have confirmed disruption of membranes by electrochemical measurements of flux of charged molecules in the presence of antimicrobial peptides. Attempts to develop resistance by subculturing several times in media containing sub-minimal inhibitory concentrations of D-TN6 peptide failed, indicating the difficulty for bacteria to develop resistance. This was an expected result, since structural change of cell membranes require several major genetic changes in order to develop resistance. These peptide antibiotics, highly active against microorganisms that threaten human health worldwide, can help combat increased antibiotic resistance.

The Role of Microscopy in the Diagnosis of Parasitic Diseases

Ahmet Özbilgin

Manisa Celal Bayar University School of Medicine Dept. of Parasitology, Manisa 45010 – Türkiye

Parasitic diseases have long been a significant threat to human life in especially developing regions of the world. Factors such as increased human immigration, global warming and political instability in certain regions of the world have all been contributing to the maintenance of these infections in also the western world today. Children, elderly people and immunocompromised individuals are more under risk for parasitic diseases. Therefore, diagnosis of parasitic diseases is essential, and microscopy has long been the primary method of choice in diagnosis. It is easy, inexpensive and common in all over the world. However, microscopy has major drawbacks such as poor sensitivity and dependence on the experience of microscopist. Improvements in the other diagnostic options, especially in molecular methods such as PCR, have increased the share of these methods against microscopy, lately. Since PCR is relatively more sensitive and specific than microscopy, it is essential for effective diagnosis; yet, it should be considered that PCR detects the DNA, not the parasite itself, and PCR positivity does not necessarily indicate active infection. In conclusion, despite those obvious technological improvements in molecular diagnosis of parasitic diseases, microscopy is still the first step as a simple, inexpensive and a common diagnostic method which could diagnose any parasite in any patient sample, anytime, shortly.

Investigating Virus Infection Mechanisms in Situ

Caner Akıl[1], Peijun Zhang[2]

[1]Division of Structural Biology, Nuffield Department of Medicine, University of Oxford, Oxford, OX3 7BN, UK; Chinese Academy of Medical Sciences Oxford Institute, Nuffield Department of Medicine, University of Oxford, Oxford, OX3 7BN, UK

[2]Division of Structural Biology, Nuffield Department of Medicine, University of Oxford, Oxford, OX3 7BN, UK; Chinese Academy of Medical Sciences Oxford Institute, Nuffield Department of Medicine, University of Oxford, Oxford, OX3 7BN, UK; Diamond Light Source, Harwell Science and Innovation Campus, Didcot, OX11 0DE, UK

Understanding the intricate mechanisms of viral entry is crucial for developing effective antiviral strategies. My research reveals the complete spectrum of intermediate stages in class I membrane fusion, using SARS-CoV-2 as a model. By leveraging cryo-electron tomography (cryo-ET) within a near-native fusion system that closely mimics the virus's entry mechanism, I have delineated the progressive stages of SARS-CoV-2 fusion with unparalleled clarity. This study uncovers dynamic conformational changes in the Spike protein, transitioning from extended intermediates to fully folded states that precede fusion pore formation. These transitions are driven by ACE2 receptor binding and S2′ cleavage, which induce structural rearrangements and Spike clustering at native membrane interfaces. Furthermore, cryo-ET and subtomogram averaging have provided novel mechanistic insights into S2-targeting antibodies, including their binding to the Spike's stem-helix on virions and their ability to inhibit fusion. These findings elucidate the complete process of Spike-mediated fusion and SARS-CoV-2 entry, highlighting the neutralizing mechanism of S2-targeting antibodies and offering significant insights for antiviral intervention.

Keywords: SARS-CoV-2, Complete Fusion, Spike Clustering, Fusion Pore, Fusion Intermediates, S2 Antibody

Decoding the Replication Machinery of Nipah Virus: Structural and Molecular Insights

Esra Balıkçı Akıl

University of Oxford, Nuffield Department of Medicine, UK

Nipah virus, listed by the WHO as a priority pathogen, causes severe respiratory and neurological disease with case fatality rates of up to 70%, yet no licensed therapeutics are available. Central to its replication is the viral polymerase complex, formed by the polymerase (L) and its cofactor, the phosphoprotein (P), which together copy and transcribe the RNA genome. Using cryo-electron microscopy (cryo-EM), we visualized the Nipah virus polymerase complex at 2.5 Å resolution, uncovering the organization of its catalytic domains and how these components associate with each other. Building on this framework, we used cryo-EM to define how nanobodies engage and disable the polymerase, effectively locking it in an inactive state. Our findings open new avenues for the rational design of nanobody-based antiviral strategies against deadly viruses including Nipah.

Global Air Isolated Workflow Solution for Battery Analysis: From Cryo FIB to TEM

Felice D'Alia

Ass. General Manager within JEOL (EUROPE) SAS. Branch office in Poland

Using human kidney organoids to study renal fibrosis and glomerular disorders

Jitske Jansen

Department of Medicine 2 (Nephrology, Rheumatology, Clinical Immunology, Hypertension), RWTH University Hospital Aachen, Aachen, Germany

Globally more than 10% of the population is suffering from chronic kidney disease. The cause can be multifactorial, but the filtering unit of the kidney, called glomerulus, is often the primary target of disease. This leads to progressive kidney failure, ultimately leading to scarring of the kidney, termed fibrosis. Fibrosis is the common hallmark of all progressive nephropathies and is irreversible. Still, there is no effective and specific therapy available to halt glomerular diseases and prevent kidney fibrosis. The lack of effective therapies is largely attributable to a lack of human disease specific disease models. We developed human induced pluripotent stem cell derived kidney organoids and successfully modeled glomerular disorders on a personalized medicine level, using single cell RNA sequencing, FIB-SEM electron microscopy and confocal super resolution immunofluorescence imaging. In addition we developed a human fibrosis atlas using 5 different injury insults. Using single cell RNA sequencing and proteomics we integrated the organoid fibrosis atlas data with publicity available human kidney omics data and identified unique and overlapping gene and protein signatures. Moreover, using experimental inhibitors we could reverse fibrosis. Recently, we developed a fully automated robotic 384-well organoid platform that will aid in high throughput target validation and drug discovery. Altogether, we successfully developed the human kidney organoid platform for modeling glomerular disorders and fibrotic disease, to uncover underlying molecular mechanisms of renal diseases and identify new therapies.

Keywords: kidney organoids, stem cells, glomerular disorders, fibrosis

Recent Advances in 3D Cell Culture: Revolutionizing Drug Discovery and Disease Modeling Through Advanced Technologies

Ranan Gulhan Aktas

CEO & Founder of Cellorama, Mansfield, Massachusetts, United States of America

Breakthroughs in **3D cell culture technologies** are revolutionizing drug discovery and disease modeling. By creating models that mimic real human tissues more closely than traditional 2D methods, we›re gaining unprecedented insights into disease mechanisms and how to develop effective therapies. This includes everything from sophisticated organ-on-chip systems to cutting-edge biomaterials.

At **Cellorama**, we're addressing key challenges in microscopy for both 2D and 3D cell cultures. Our platform protect delicate samples like stem cells, organoids, and spheroids throughout processing and analysis, drastically cutting down on damage and artifacts, leading to more reproducible and accurate data. **CellO-IF** accelerates immunofluorescence workflows by up to five times with superior labeling, and **CellO-M** enables multidimensional imaging at both light and electron microscope levels —all without disturbing the crucial 3D morphology of samples. These simple and easy to use tools enable high-resolution images while reducing costs and minimizing human errors.

We will explore examples from publications and experiments worldwide, delve into novel methods for labeling and examining organoids and spheroids, and enjoy captivating videos and images.

References:

1. OE Tok et al. Culturing, Freezing, Processing, and Imaging of Entire Organoids and Spheroids While Still in a Hydrogel. J Vis Exp 2022
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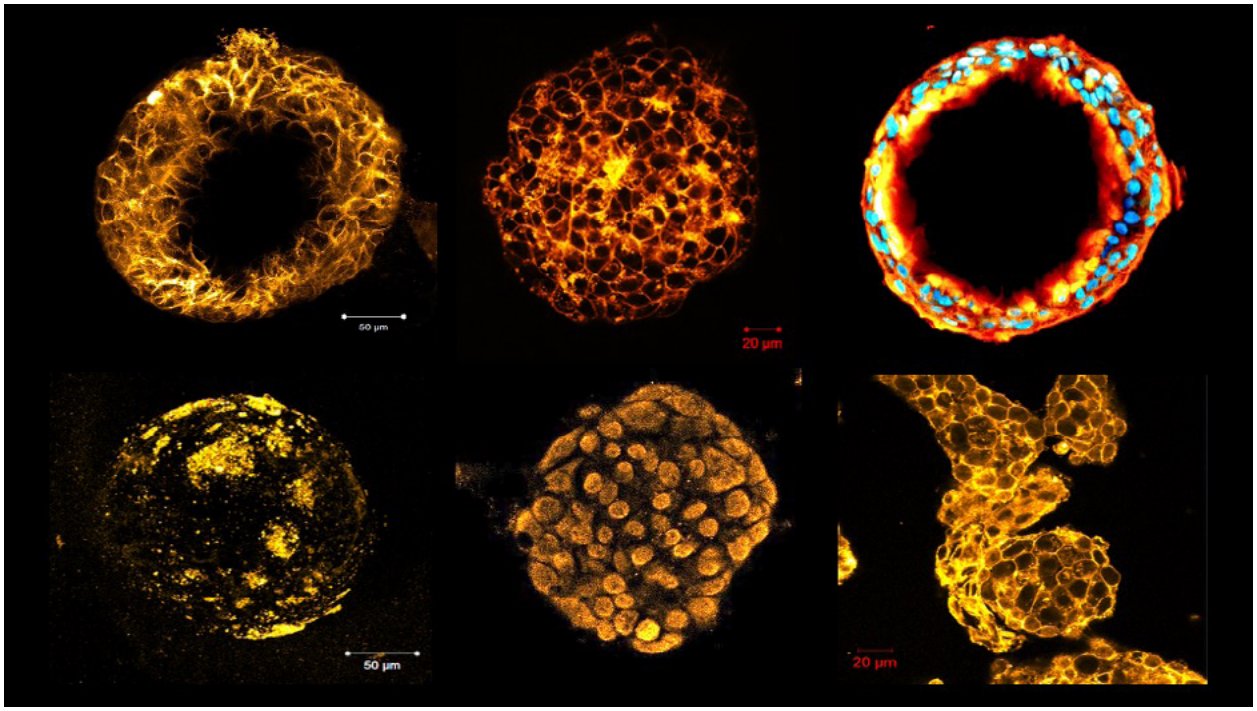
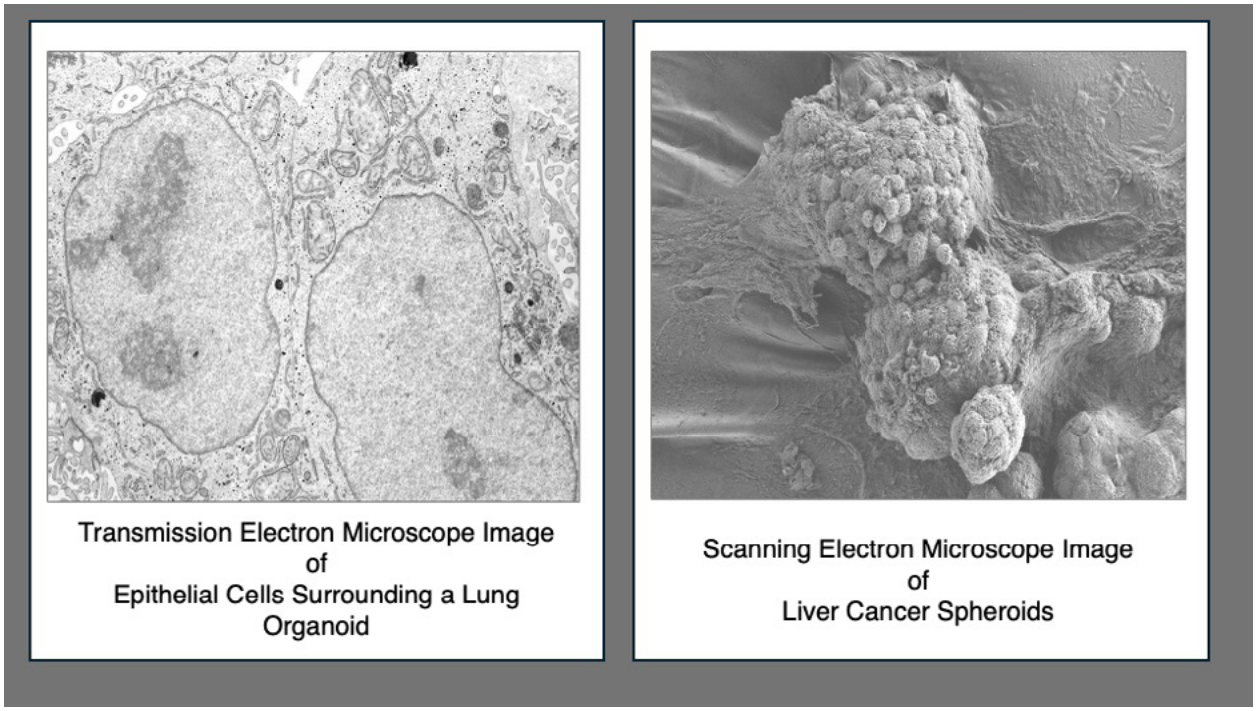
3. G Demirel et al. A Simplified and Robust Immunofluorescence Labeling Method for Complex 3D Cell Cultures: Minimizing Manipulation and Maximizing Data in Whole-Mount Analysis of Organoids, Spheroids, and Co-culture Models. Methods Mol Biol 2025



Confocal Microscopic Images-Lung Organoids and Liver Cancer Spheroids : *These images demonstrate lung organoids and liver cancer spheroids processed and stained using Cellorama's technologies. They were first cultured in CellO-Ms, which are multipurpose cell culture dishes, then precisely immunofluorescence-labeled using CellO-IF, and finally visualized under a confocal microscope while still in CellO-Ms.*



Electron Microscopic Images -A Lung Organoid and Liver Cancer Spheroids: *The images showcase a lung organoid epithelium under transmission electron microscope and liver cancer spheroids under scanning electron microscope, visualized using Cellorama's technologies.*

Enhanced human placenta organoids with immune and vascular components for in vivo-like function, disease modeling, and therapeutic testing

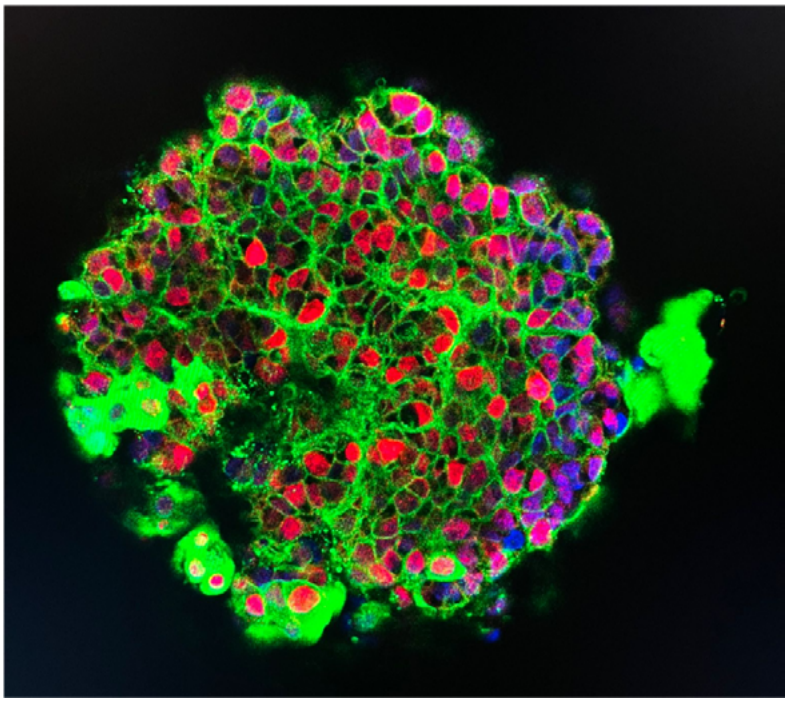
Ciler Celik-Ozenci

Department Of Histology And Embryology, School Of Medicine, Koç University, Istanbul, Turkiye

The human placenta plays a central role in regulating fetal development and maternal physiological adaptation during pregnancy. However, conventional models such as 2D cultures and animal systems are limited in their ability to accurately recapitulate the cellular complexity and dynamic microenvironment of the human placenta. To address this, a novel class of advanced human placenta organoids has been developed, incorporating both immune and vascular components to more faithfully replicate in vivo placental architecture and function. These enhanced organoids integrate trophoblast, endothelial, and innate immune cell populations within a three-dimensional scaffold, enabling the study of key physiological processes including trophoblast invasion, immune modulation, and placental vascularization. This platform represents a significant advancement in reproductive biology, providing a scalable, ethically sustainable, and highly tunable system for modeling normal and pathological placental states. Applications include mechanistic studies of pregnancy complications—such as preeclampsia and fetal growth restriction—as well as preclinical testing of therapeutics and evaluation of gestational drug safety. By bridging the gap between traditional in vitro models and the complex in vivo environment, these enhanced placenta organoids offer a powerful new tool for advancing maternal-fetal medicine, developmental biology, and translational research.

Keywords: Human placenta organoids, HUVEC, uNK cells

Human placenta organoid.



Characterization of human placenta organoids by confocal microscopy imaging.

ORAL PRESENTATIONS

OP-0022 - Main Topics in Biological Sciences - Biomaterials and Tissue Engineering

Formulation and analysis of gellan gum hybrid hydrogels with silk fibrin and sodium alginate for enhanced culturing of mouse embryonic stem cells and extracellular matrix simulation

Terin Adali[1], Hafize Seda Vatansever[2], Hilal Kabadayi Ensarioglu[3], Mthabisi Talent George Moyo[4]

[1]Department of Medical Biochemistry, Faculty of Medicine, Girne American University, Mersin 10, Turkey, Research and Applications Center of Biomedical Sciences, Girne American University, Mersin 10 Turkey

[2]Department of Histology & Embryology, Faculty of Medicine, Manisa Celal Bayar University, Manisa, Turkey, DESAM Research Institute, Near East University, Mersin 10 Turkey

[3]Department of Histology & Embryology, Faculty of Medicine, Bakircay University, Izmir, Turkey

[4]Department of Medical Biochemistry, Faculty of Medicine, Girne American University, Mersin 10, Turkey, Research and Applications Center of Biomedical Sciences, Girne American University, Mersin 10 Turkey, Department of Biomedical Engineering, Faculty of Engineering, Near East University, Mersin 10 Turkey

INTRODUCTION: In regenerative medicine, the selection of the optimal stem cell type is pivotal due to their diverse differentiation potentials and interactions with the extracellular matrix (ECM). Although Gellan Gum-based hydrogels have been extensively studied with various cell types, their application with mouse embryonic stem cells (mESCs), which exhibit unique characteristics, remains underexplored.

AIM: This study focuses on evaluating Gellan Gum-based hydrogels, in conjunction with silk fibroin and sodium alginate, as substrates for mESC culture to better replicate ECM conditions and address the limitations of existing systems.

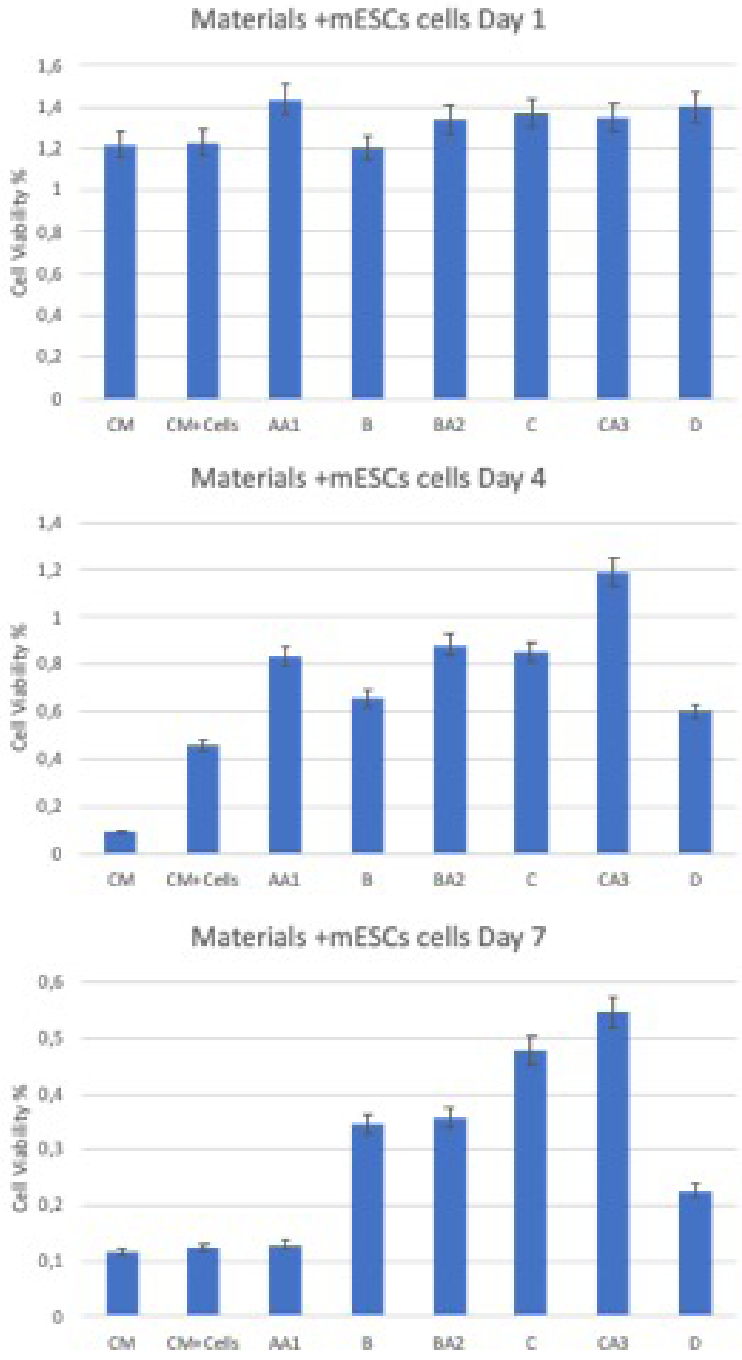
MATERIALS-METHODS: Hydrogels were synthesized with Gellan Gum concentrations of 0.3%, 0.5%, 0.75%, and 1%, combined with 3% silk fibroin and 4.2% sodium alginate respectively. Comprehensive evaluations included swelling kinetics in phosphate buffer solution (pH 7.4) and acetic buffer solutions (pH 1.2), thermal properties analyzed via Differential Scanning Calorimetry (DSC), and surface morphology characterized using Scanning Electron Microscopy (SEM). mESCs cultures were established on mitomycin-C-treated mouse fibroblast cells. Cell viability assays and cytotoxicity detection were performed for both control and study groups on days 1, 4, and 7 using lactate dehydrogenase (LDH) and MTT assays.

RESULTS: Results demonstrated that hydrogels with 0.5% and 0.75% Gellan Gum concentrations exhibited optimal swelling behavior, cytocompatibility, and mechanical properties. Specifically, Gellan Gum-silk fibroin hydrogels effectively supported cell viability, while Gellan Gum-sodium alginate hydrogels displayed enhanced stability. DSC analysis revealed that silk fibroin decreased the peak thermal transition temperature, whereas sodium alginate increased it. SEM imaging indicated that higher Gellan Gum concentrations improved scaffold rigidity, with silk fibroin contributing to enhanced flexibility and surface smoothness.

CONCLUSION: These findings suggest that Gellan Gum-based hydrogels have significant potential for mimicking ECM in tissue engineering applications. Future research should evaluate them in vivo biocompatibility, and investigate their long-term stability, degradation characteristics, and potential for incorporating bioactive molecules.

Keywords: Gellan Gum, Silk fibroin, Sodium alginate, Hydrogels, Mouse embryonic stem cells, Extracellular matrix

Figure 1



MTT results for day 1, 4 and 7 of mESC cultured with Culture medium (CM), Culture medium+cell (CM+Cells), AA1, B, BA2, C, CA3 and D materials.

OP-0027 - Main Topics in Biological Sciences - Pathology

Dynamical ultrastructural evaluation of variation respiratory ciliated epithelial cells under administration of macrophage migration inhibitory factor: Animal model of study

Aygun Aliyarbayova[1], Ilgar Hasanov[2], Tamilla Sultanova[1], Mahir Quliyev[1], Tarana Najafova[1], Tubu Ibrahimova[1], Raya Haqverdiyeva[1]

[1]Department of Cytology, Embryology and Histology, Azerbaijan Medical University, Baku

[2]"Ozon" Medical Centre, Ganja, Azerbaijan

INTRODUCTION: Macrophage Migration Inhibitory Factor(MIF) a multifunctional cytokine,has numerous targets of action in inflammatory. However,there is no information on the effect of exogenous MIF on respiratory ciliated epithelium with kinetic function cilia.

AIM: The aim of the study was to investigate the dynamics of ultrastructural changes in bronchial ciliated epithelial cells after MIF injection.

MATERIALS-METHODS: The study was carried out on 60 adult male Wistar albino rats (intact, placebo(saline injection), main(administration of MIF(ProSpec CYT-193,Ness-Ziona))groups) taken from Scientific Research Center of Azerbaijan Medical university.Under anesthesia by ketamine the samples (from 1st to 4th generation of bronchi) were taken 2 hours,2,3,7,15 and 30days after injection.The Araldite Epon blocks,ultrathin sections prepared accordingly to general methods used on transmission electron microscopic investigation.Ultrastructural analysis was performed on a JEM-1400 transmission electron microscope(Jeol,Japan).Quantitative data were processed using variance statistics,the mean value and its standard error(M±m) were calculated at a confidence level of P=0.95($p<0.05$).

RESULTS: Although the number of ciliated cells gradually decreases along the bronchial branching in intact groups of rats,they remain in the terminal bronchi(4th generation).In the placebo groups, changing in ciliated epitheliocytes were of a "reactive" non-specific nature.In the main groups,damage and detachment of ciliated epitheliocytes from the epithelial lining are maximum during 2 hours to 2 days after MIF injection.Alteration are more sharply revealed in bronchi of the 3rd-4th generation,compared to the 1st-2nd generation.Prominent ultrastructural lesions were noted in the cell membrane,nucleus,cilia,most of the cytoplasmic compartments,mitochondria, cytoskeleton and intercellular contacts of ciliated epithelial cells. The general pattern of observations after MIF injection is as follows: induction of alteration and disruption; stabilization and gradual restoration of ultrastructural organization.

CONCLUSION: Thus, MIF injection impact on epithelial cells with kinetic cilia. Alteration and breaks in the first stage are subsequently stabilized and replaced by repair. Our results point to the importance of systematic electron microscopic studies in this direction.

Keywords: respiratory ciliated epithelium, rat, ultrastructure, inflammation

OP-0028 - Main Topics in Biological Sciences - Tissues and Systems

Acetyl-L-carnitine as a modulator of steroidogenic dysfunction induced by chronic ethanol exposure

Merve Gorgulu[1], Gizem Gamze Tas[1], Gamze Zengin[1], Hakan Er[2], Sevim Ercan[3], Leyla Sati[1]

[1]Department of Histology and Embryology, School of Medicine, Akdeniz University, Antalya, Turkey

[2]Department of Medical Imaging Techniques, Vocational School of Health Services, Akdeniz University, Antalya, Turkey; Department of Biophysics, School of Medicine, Akdeniz University, Antalya, Turkey

[3]Department of Medical Laboratory Techniques, Vocational School of Health Services, Akdeniz University, Antalya, Turkey

INTRODUCTION: Chronic ethanol (EtOH) intake generates toxic acetaldehyde and excess reactive oxygen species, leading to oxidative stress, endoplasmic reticulum stress, and apoptosis. These effects disrupt testicular steroidogenesis and reduce testosterone synthesis, contributing to male infertility. Although acetyl-L-carnitine (ALCAR) shows antioxidant and cytoprotective effects in various models, its role in alcohol-induced testicular dysfunction remains unclear.

AIM: The present study aims to evaluate whether ALCAR administration could attenuate chronic EtOH-induced testicular damage in rats by assessing key components of the steroidogenic pathway, alongside serum levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH) and testosterone.

MATERIALS-METHODS: Experimental groups included control, EtOH (5 g/kg of 25% ethanol, administered via oral gavage), ALCAR (50 mg/kg, oral gavage), and combined EtOH+ALCAR treatment (n=10 per group), with all animals monitored over 4 weeks. Testicular expression levels of key steroidogenic markers, StAR, 17β-HSD3, 3β-HSD and P450scc, were assessed using immunohistochemistry (IHC) and western blotting (WB). Serum concentrations of LH, FSH, and testosterone were quantified via ELISA.

RESULTS: IHC and WB analyses showed reduced protein expression of LHR ($p<0.01$), P450scc ($p<0.001$), 3β-HSD ($p<0.05$), 17β-HSD3 ($p<0.05$) and StAR ($p<0.01$) in the EtOH group. In contrast, co-administration of ALCAR with EtOH significantly restored the expression of LHR, P450scc, 3β-HSD, and 17β-HSD3 ($p<0.05$). Moreover, StAR protein expression ($p<0.01$), as well as serum LH ($p<0.05$), FSH ($p<0.01$), and testosterone ($p<0.05$) levels were significantly decreased in all experimental groups compared to the control.

CONCLUSION: This study provides novel evidence that ALCAR modulates testicular steroidogenesis and circulating levels of reproductive hormones, LH, FSH, and testosterone, under chronic ethanol exposure. The results suggest a potential protective role for ALCAR against alcohol-induced reproductive dysfunction by partially restoring the expression of key steroidogenic proteins. Further research is warranted to validate its therapeutic efficacy and long-term effects on alcohol-related male infertility.

Keywords: acetyl L-carnitine, chronic alcoholism, rat, steroidogenesis, testis

OP-0033 - Main Topics in Microscopy Techniques - Advanced Microscopy Techniques

Digital twins in illumination and colour in microscopy and spectroscopy

Kazim Hilmi Or

Private Office of Ophthalmology, Germany

BACKGROUND: Digital twins, virtual counterparts of physical systems, have emerged as powerful tools in the advancement of microscopy and spectroscopy. Particularly in the context of illumination and colour, digital twins provide novel approaches for simulating and controlling optical environments. Traditionally, optimization of lighting conditions and spectral fidelity required repeated physical adjustments. With digital twins, these parameters can now be explored virtually, enhancing both efficiency and reproducibility in experimental design.

METHODS: This review synthesizes recent developments in the application of digital twins for illumination and colour management in microscopy and spectroscopy. We evaluate methods for virtual simulation, including ray tracing, light-field modeling, spectral response prediction, and integration with machine learning algorithms. Emphasis is placed on adaptive illumination systems, spectral unmixing models, and the use of real-time feedback loops. Additionally, we assess platforms for virtual prototyping of optical systems, enabling the exploration of high-NA objectives, multi-photon setups, and AR/VR-assisted imaging environments.

RESULTS: Studies demonstrate that digital twins significantly improve the predictive power and adaptability of optical system design. For example, adaptive illumination strategies guided by digital twins reduce photobleaching and optimize fluorescence intensity. Colorimetric simulations enable better discrimination of overlapping fluorophores and enhance multi-channel imaging. Virtual experimentation has led to reduced development time and cost in microscope system prototyping. Moreover, AI-enhanced digital twins allow for real-time parameter adjustment, increasing throughput and accuracy in data acquisition.

CONCLUSION: Digital twins are redefining the standards of precision and flexibility in microscopy and spectroscopy. Their ability to simulate complex illumination and colour scenarios, coupled with real-time optimization, makes them essential tools for modern imaging workflows. As digital twin frameworks become increasingly sophisticated, their integration with artificial intelligence and multimodal imaging promises to further revolutionize the field, bridging the gap between virtual modeling and experimental microscopy.

Keywords: Digital twins, Illumination simulation, Colorimetric modeling, Virtual prototyping, Microscopy and spectroscopy

OP-0034 - Main Topics in Microscopy Techniques - Artificial Intelligence and Microscopy

State-of-the-art applications of artificial intelligence in illumination control in microscopy

Kazım Hilmi Or

Private Office of Ophthalmology

BACKGROUND: The precision and quality of optical microscopy critically depend on the control of illumination. Traditional illumination systems often rely on static parameters or user-defined presets, which may be suboptimal for diverse biological samples and experimental conditions. Recent advances in artificial intelligence (AI) offer the potential to revolutionize illumination strategies by enabling adaptive, context-aware, and predictive control mechanisms.

METHODS: This review systematically analyzes recent developments in the integration of AI techniques—such as deep learning, reinforcement learning, and Bayesian optimization—into the domain of illumination control in microscopy. The literature was surveyed using peer-reviewed journals and conference proceedings indexed in PubMed, IEEE Xplore, Web of Science, Scopus and CrossRef between 2015 and 2024. Thematic analysis was applied to categorize contributions according to their methodological approach and application domain, including structured illumination, light-sheet microscopy, and live-cell imaging.

RESULTS: AI has been successfully implemented to enable dynamic adaptation of illumination parameters, thereby improving signal-to-noise ratio, reducing phototoxicity, and enhancing imaging throughput. Reinforcement learning agents dynamically optimize laser intensity and exposure time based on real-time feedback. Convolutional neural networks guide spatially resolved illumination, targeting regions of biological interest. Bayesian optimization techniques are employed to explore optimal light configurations with minimal experimental iterations. Moreover, AI models enhance spectral tuning, multimodal switching, and real-time simulation of illumination conditions through digital twins. Hardware-level implementations, such as AI-on-the-edge, further allow low-latency illumination control embedded directly into microscope systems.

CONCLUSION: The convergence of AI and microscopy illumination technologies is ushering in a new era of intelligent imaging systems. These innovations enable microscopes to autonomously adapt to sample conditions and experimental goals, ultimately enhancing data quality and experimental efficiency. Future developments are expected to incorporate self-supervised learning and broader generalization across imaging modalities and hardware platforms.

Keywords: Adaptive Illumination Control, Artificial Intelligence in Microscopy, Reinforcement Learning, Phototoxicity Minimization, Smart Imaging Systems.

OP-0037 - Main Topics in Biological Sciences - Cancer Biology

In vitro evaluation of a multi-kinase inhibitor TAS-115 on Temozolamide sensitive U87MG cells

Ece Oylumlu, Emine Yazici, Aleyna Gezen, Gamze Tanriover

Department of Histology and Embryology, Faculty of Medicine, Akdeniz University, Antalya, Turkiye

INTRODUCTION: Glioblastoma (GBM) is the most common malignant tumor of the central nervous system. The clinical treatment of GBM consists of maximal surgical resection followed by radiotherapy and chemotherapeutic agent temozolomid(TMZ). Due to tumor heterogeneity in GBM, patients eventually develop resistance to TMZ. Therefore, there is an urgent need for novel treatment strategies that can either enhance sensitivity to TMZ or serve as effective alternative. TAS-115 is a multi-kinase inhibitor targeting c-MET and VEGFR2 signaling thereby decreasing tumor progression in different cancer.

AIM: We aimed to evaluate the efectiveness of TAS-115 on U87MG cell proliferation, motility and c-MET and VEGFR2 mediated signaling patways in vitro.

MATERIALS-METHODS: U87MG cells were used. Experimental groups were established as Control, DMSO, TMZ, TAS-115 and TMZ+TAS-115 in which U87MG cells were treated with DMSO (vehicle), TMZ, TAS-115 and combination of TMZ and TAS-115. MTT assay were performed to determine the IC50 concentrations of TMZ and TAS-115. Colony formation assay were performed to evaluate proliferation rate. The individual and combinatory effect of TMZ and TAS-115 on cellular motility were assessed performing wound healing and invasion assay. Additionally, c-MET and VEGFR2 signaling pathway were evaluated with immunocytochemistry.

RESULTS: IC50 concentration of TAS-115 on U87MG cells were determined. TAS-115 treatment reduced cell viability and potentiated TMZ-induced reduction in cell viability ($p<0.001$). Colony forming potential of cells were slightly diminished with TAS-115. However, co-treatment with TAS-115 and TMZ greatly reduced colony formation. Migration of cells were reduced with TAS-115. Additionally, p-MET, p-VEGFR2 and their downstream signaling proteins including p-ERK, p-mTOR, p-STAT-3 and NF-κB protein expressions were reduced in TAS-115 treated cells ($p<0.001$).

CONCLUSION: This study targeted c-MET and VEGFR2 kinases in vitro that are overly activated in GBM. Collectively, the results of this study will thus contribute to the development of alternative or complementary treatments to TMZ.

Keywords: Glioblastoma, Temozolomide, RTK inhibitors

OP-0044 - Main Topics in Biological Sciences - Organoids

3D bioprinting of a patient-derived breast cancer organoid model for immunotherapeutic screening

Sendegul Yildirim[1], Momoka Nagamine[2], Myoung Hwan Kim[3], Ilayda Namli[4], Amanda Blanque Becceneri[4], Lina Kozhaya[5], Deren Aslan[6], Veli Ozbolat[6], Ertuğrul Bayram[6], Semra Paydas[6], Derya Unutmaz[6], Ibrahim Ozbolat[7]

[1]The Huck Institutes of the Life Sciences, Engineering Science and Mechanics, Penn State University University Park, PA 16802, USA; Department of Histology and Embryology, Ufuk University Ankara 06520, Turkey

[2]Department of Chemistry, The Huck Institutes of the Life Sciences, Penn State University University Park, PA 16802, USA

[3]The Huck Institutes of the Life Sciences, Biomedical Engineering Department, Penn State University University Park, PA 16802, USA

[4]The Huck Institutes of the Life Sciences, Engineering Science and Mechanics, Penn State University University Park, PA 16802

[5]The Jackson Laboratory for Genomic Medicine Farmington, CT 06032, USA

[6]Biotechnology Research and Application Center, Department of Medical Oncology, Cukurova University Adana 01330, Turkey

[7]The Huck Institutes of the Life Sciences, Biomedical Engineering Department, Engineering Science and Mechanics, Materials Research Institute, Penn State University University Park, PA 16802, USA; Cancer Institute, Penn State University Hershey, Neurosurgery Department, Penn State University Hershey, PA 17033, USA; Biotechnology Research and Application Center, Department of Medical Oncology, Cukurova University Adana 01330, Turkey

AIM: Breast cancer remains a major cause of cancer-related deaths among women. Its heterogeneity, defined by hormone receptor and HER2 status, necessitates personalized treatment strategies. Conventional 2-dimensional (2D) cultures poorly mimic the tumor microenvironment. While 3-dimensional (3D) organoids offer physiological relevance, they often lack reproducibility. 3D bioprinting enables standardized and controlled organoid formation. We hypothesize that bioprinted patient-derived organoids (PDOs) can serve as a consistent platform for immunotherapy evaluation. This study aims to generate a 3D bioprinted breast cancer PDO model and assess HER2-targeted CAR-T cell efficacy.

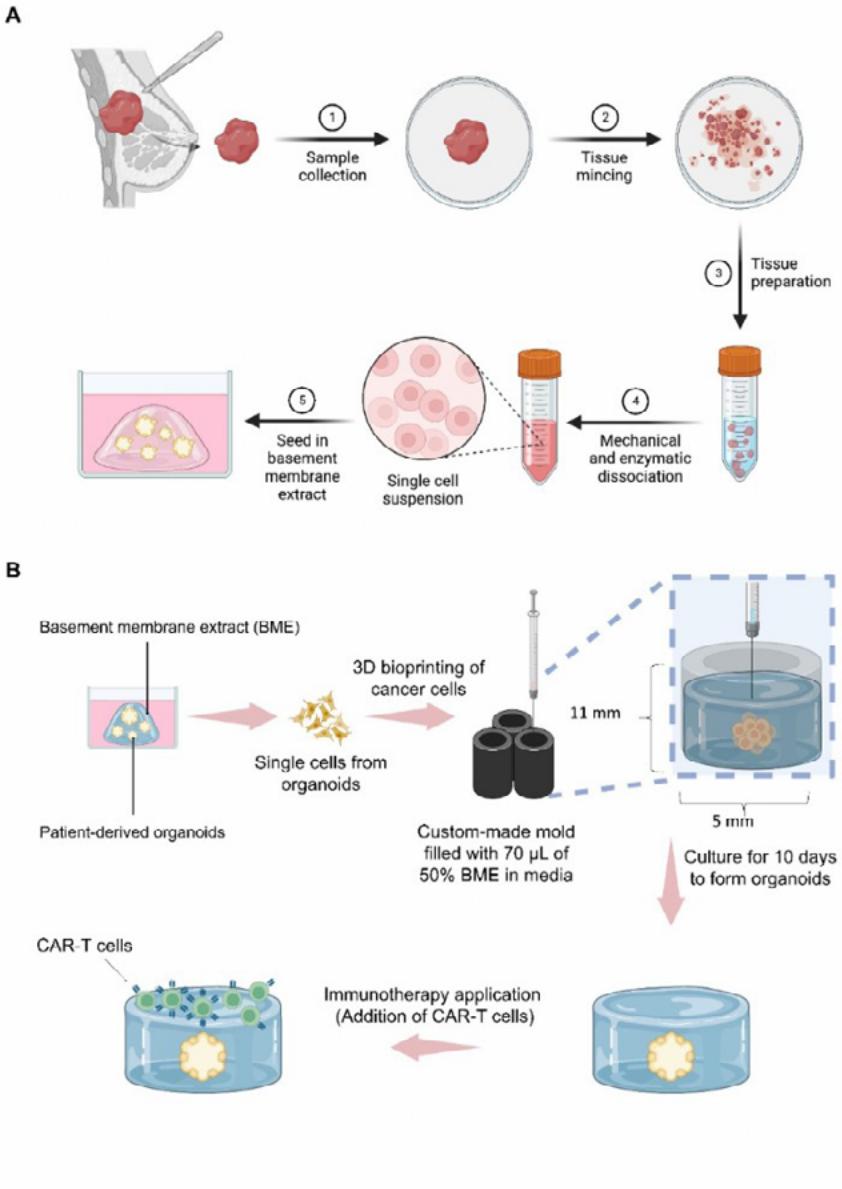
MATERIALS-METHODS: Primary breast cancer cells isolated from patient biopsies were enzymatically dissociated and mixed with Cultrex basement membrane extract. Using pneumatic extrusion 3D bioprinting, uniform cell-laden droplets were deposited into multi-well plates to produce organoids with controlled size and structure. After seven days of maturation, HER2-specific CAR-T cells were co-cultured with PDOs at defined effector-to-target (E:T) ratios. Cell viability was measured at 24, 48, and 72 h post-treatment using ATP-based luminescence assays. Expression of Bax, Bcl-2, and Caspase-3 genes was assessed by qRT-PCR. Immunofluorescence was used to visualize CAR-T cell infiltration and apoptosis.

RESULTS: HER2-targeted CAR-T cells significantly reduced the viability of HER2-positive PDOs by ~55% compared to controls ($p<0.01$). HER2-negative PDOs showed minimal response (~15% viability reduction). qRT-PCR showed upregulation of Bax and Caspase-3 and downregulation of Bcl-2 in HER2-positive treated PDOs ($p<0.05$). Immunofluorescence confirmed CAR-T infiltration and increased apoptosis.

CONCLUSION: 3D bioprinted breast cancer PDOs provide a reproducible and physiologically relevant platform for immunotherapy screening. The model enables precise control over organoid formation and facilitates the investigation of tumor-immune dynamics. HER2-specific CAR-T cells showed promising efficacy, supporting the platform's utility in personalized cancer therapy development.

Keywords: Breast Cancer, Organoids, 3D Bioprinting, Cancer immunotherapy

Schematic showing (A) the deviation of breast cancer PDOs and (B) 3D bioprinting of PDOs.



OP-0046 - Main Topics in Biological Sciences - Tissues and Systems

Investigation of the effects of Bergenin on CD4+T cells in imiquimod-induced psoriasis mouse model

Mustafa Cakir[1], Eda Acikgoz[2], Seda Keskin[2]

[1]Department of Medical Biology, Faculty of Medicine, Van Yuzuncu Yil University, Van, Turkiye

[2]Department of Histology and Embryology, Faculty of Medicine, Van Yuzuncu Yil University, Van, Turkiye

INTRODUCTION: Psoriasis is a chronic inflammatory skin disease, and immune system cells, especially T lymphocytes, play a key role in its pathogenesis (Luo, 2025).

AIM: Bergenin (BER) dramatically lessens the severity of psoriasis, according to studies done on a psoriasis mouse model for a doctoral thesis (Keskin et al. 2024). In this regard, the current work intends to assess the immunoregulatory effects on $CD4^+$ and $CD3^+$ T cell populations in a psoriasis mouse model of the BER drug, which is well-known for its anti-inflammatory qualities and demonstrated effectiveness in ex vivo investigations on helper T (Th) cell growth.

Materials & METHODS: The effects of CD4+ T cells (Th1, Th17, Th22, and Treg) and CD3+ T cells on the release of IL-6, IL-10, IL-22, and TNF-α cytokines in mouse inguinal lymph node and spleen tissues were thoroughly characterized by flow cytometry to clarify the mechanism of action of BER. Flow cytometry results were analyzed using the BD Fascaria III Flow Cytometry or FlowJo. Data were performed with Student t test using Graphpad.

RESULTS: In the results, significant increases in the percentage of $CD4^+$, $CD4^+IL\text{-}17^+$, $CD4^+IFN\text{-}\gamma^+$ and $CD4^+IL\text{-}22^+$ T cells were observed in the IMQ group, whereas a significant decrease in the percentage of $CD3^+CD25^+Foxp3^+$ Treg cells was found. While BER therapy stabilized the $CD4^+$ T cell population, it dramatically reduced Th17 cells ($CD4^+IL\text{-}17^+$) and proinflammatory $IL\text{-}22^+$ cells. Furthermore, $CD3^+TNF\text{-}\alpha^+$ T cell ratio was significantly decreased in the treatment group compared to the IMQ group.

CONCLUSION: Our results showed that BER has the potential to restore immune homeostasis by suppressing proinflammatory T cell responses in psoriasis mouse model and may be an effective therapeutic candidate, especially with its Th17/Treg balance regulating effects. More detailed studies are needed to fully understand the immunomodulatory activity of BER and to transfer it to clinical applications.

Keywords: Psoriasis, T cell, Th17, Treg, Th22, Bergenin

This study was supported by the Scientific Research Projects Unit of Van Yüzüncü Yıl University under project number TDK-2022-10132 and by TÜBİTAK under module 1002-B with code 123S058.

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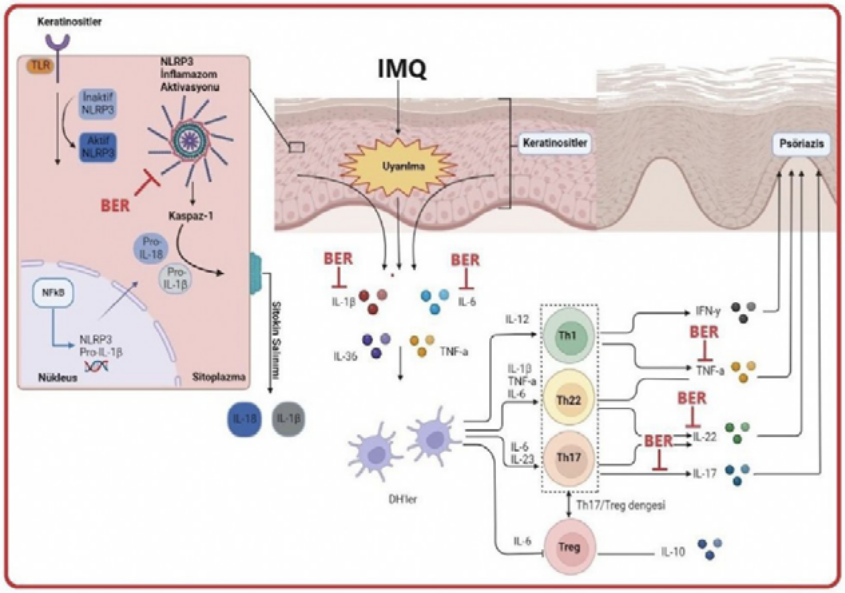
Acknowledgement note to organisations supporting the study

Figure 1. Immunomodulatory effects of Bergenin in an imiquimod (IMQ)-induced mouse psoriasis model.



OP-0055 - Main Topics in Biological Sciences - Stem Cell Biology

Association of VEGFR-2 expression in mesenchymal stroma cells with angiogenesis in preeclampsia

İbrahim Alptekin[1], Bilge Serdaoğlu[2], Ezel Erkan[1], Mesut Akyol[3], Ferda Topal Çelikkan[1], Mohammadreza Dastouri[4], Derya Uyan Hendem[5], Dilek Şahin[6], Alp Can[1]

[1]Department of Histology and Embryology, Ankara University School of Medicine, Ankara, Türkiye

[2]Kahramanmaraş Necip Fazıl City Hospital, Kahramanmaraş, Türkiye

[3]Department of Biostatistics and Medical Informatics, Ankara Yıldırım Beyazıt University, Faculty of Medicine, Ankara, Türkiye.

[4]Faculty of Medical Biology, School of Medicine, Ankara Medipol University, Ankara, Türkiye.

[5]Şanlıurfa Training and Research Hospital, Department of Obstetrics and Gynecology, Perinatology, Yenice, Şanlıurfa, Türkiye

[6]Perinatology Clinics, Obstetrics and Gynecology Department, Ankara Bilkent City Hospital, Ankara, Türkiye.

AIM: Human umbilical cord mesenchymal stromal cells (hUC-MSC) originate from extra embryonic mesoderm. They exhibit proangiogenic properties in utero. They exert their effects through nanoparticles known as exosomes. The proangiogenic potential may be altered in some diseases that have an effect on angiogenesis. Preeclampsia may affect the angiogenic potential of hUC-MSC given its impact on the development of preeclampsia and angiogenesis. We aimed to compare the effect of the onset of preeclampsia on the angiogenic potential of hUC-MSC through VEGFR-2 levels expressed in cell culture and tissue and in vitro angiogenesis performance.

MATERIALS-METHODS: We labeled umbilical cord cryosections of three different groups of subjects -Control, EPE, GPE (Early and late onset preeclampsia) with VEGFR-2 antibody and analyzed VEGFR-2 levels in SAS (subamniotic stroma), IVS (intervascular stroma), PVS (perivascular stroma). VEGFR-2 mRNA levels of each group measured by qRT-PCR analysis. exosomes of each group were evaluated in matrigel in vitro angiogenesis assay on HUVEC. $p<0.05$ values at all analysed data were considered statistically significant.

RESULTS: No fundamental difference in the signal level of VEGFR-2 in the different groups. The signal intensity of SAS is weaker than PVS and IVS. Preeclampsia groups are significantly weaker signal intensity than control groups in cell cultured VEGFR-2 labelling in regardless of onset of preeclampsia. Preeclampsia groups expressed weaker mRNA levels in qRT-PCR in cord samples compared to control groups. Preeclampsia exosomes exhibited poorer angiogenetic performance compared to control exosomes. The differences between the two different subtypes of pre-eclampsia are not statistically significant.

CONCLUSION: Finally, hUC-MSC maintains its angiogenic potential in postnatal period. Preeclampsia negatively affects the angiogenic potential of hUC-MSC regardless of its onset. The onset of pre-eclampsia makes no difference to angiogenesis.

The study was supported by the Scientific Research Coordination Department with the project number TSG-2022-2545.

Keywords: early onset preeclampsia, late onset preeclampsia, hUC-MSC, in vitro angiogenesis, exosome, VEGFR-2

OP-0059 - Main Topics in Microscopy Techniques - Imaging of Biomolecules

Fourier Transform Infrared Microscopy (FTIRM) for multimodal characterization of disease- and drug-induced tissue alterations

Ceren Çelik[1], Sebnem Garip Ustaoglu[2], Feride Severcan[3]

[1]Department of Neuroscience, Institute of Health Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkiye; Biomedical Sciences Graduate Program, Institute of Graduate Studies, Altinbas University, Istanbul, Turkiye

[2]Department of Medical Biochemistry, Faculty of Medicine, Altinbas University, Istanbul, Turkiye; Biomedical Sciences Graduate Program, Institute of Graduate Studies, Altinbas University, Istanbul, Turkiye

[3]Department of Biophysics, Faculty of Medicine, Altinbas University, Istanbul, Turkiye; Biomedical Sciences Graduate Program, Institute of Graduate Studies, Altinbas University, Istanbul, Turkiye

INTRODUCTION: Fourier transform infrared microscopy (FTIRM) is a spectroscopic imaging technique that allows label-free, rapid, and non-destructive analysis of the molecular chemistry of biological tissues by correlating their morphology. FTIRM has recently shown significant potential in diagnosis and therapeutic monitoring across various medical fields, particularly in pathology and biochemistry.

AIM: This study aims to demonstrate two applications1,2 of FTIRM on hard and soft tissues to determine epilepsy/anti-epileptic drugs and traumatic brain injury-induced biochemical changes respectively in bone and brain tissues.

MATERIALS-METHODS: Absorption maps obtained from point-to-point scanning of desired regions of a micrometer-thick tissue section with FTIRM provide information about molecular changes in the tissue. In both soft and hard tissues, besides detecting structural changes of the tissues, biochemical changes such as protein/lipid ratio, lipid unsaturation index and protein content in brain tissue as well as mineral/matrix ratio, collagen maturation and mineral crystallinity in bones were calculated by taking the band area and/or intensity ratios of the related bands. Those parameters were represented by color-coded absorption maps.

RESULTS: In the first study1, the protein content and lipid unsaturation index which gives information about lipid peroxidation were significantly increased 24 hours after the trauma. However, while lipid parameters approached the levels of the healthy control group one month later, protein content was still not close to control. In the second study2, epilepsy caused a decrease in the mineral content and collagen structure of bones, as well as an increase in crystallinity value, independent of drug effects. Anti-epileptic treatment with carbamazepine worsened this situation, causing a decrease in bone strength.

CONCLUSION: FTIRM is a multidisciplinary imaging tool with the ability to examine different pathological regions independently without need for staining in the same tissue section. This makes the method a strong candidate for biomedical research, diagnostic imaging, and therapeutic monitoring.

Keywords: Fourier transform infrared imaging, FTIR microscopy, biochemical maps, pathological examination, diagnostic imaging, therapeutic monitoring

OP-0062 - Main Topics in Biological Sciences - Tissues and Systems

The overlooked residents of the umbilical cord: telocyte-like cells in stromal microenvironment

Ezel Erkan[1], Ibrahim Alptekin[1], Bilge Serdaroglu[2], Ferda Topal Celikkan[1], Mohammadreza Dastouri[3], Serife Esra Cetinkaya[4], Alp Can[1]

[1]Laboratory for Stem Cells and Reproductive Cell Biology, Department of Histology and Embryology, School of Medicine, Ankara University, Ankara, Turkiye

[2]Kahramanmaras Necip Fazil City Hospital, Kahramanmaras, Turkiye

[3]Medical Biology Department, School of Medicine, Ankara Medipol University, Ankara, Turkiye

[4]Obstetrics and Gynecology Department, School of Medicine, Ankara University, Ankara, Turkiye

AIM: This study aimed to investigate the existence of telocytes for the first time within the stroma of the human umbilical cord (hUC), together with mesenchymal stromal cells (MSCs). By examining their existence and distribution in the hUC stroma, this study focus to enhance the current understanding of the stem cell niche within this tissue.

MATERIALS-METHODS: Sixteen UC samples obtained from healthy cesarean deliveries were used. Tissue sections were examined using histological staining, molecular markers with super-resolution confocal microscopy (SR-CM), and transmission electron microscopy (TEM). Cell cultures were established from the UCs, followed by flow cytometry (FC) analyses. Additionally, labeled cells were examined using SR-CM and scanning electron microscopy (SEM).

RESULTS: Histological examinations showed telocyte-like cells (TLCs) with long and slender extensions particularly concentrated around stromal clefts. TEM identified the TLCs accompanying to collagen-synthesizing stromal cells. SEM revealed intercellular contacts between each other and with stromal cells. To isolate TLCs; FC with stainings for CD34, PDGFR-α (Platelet Derived Growth Factor Receptor-α), and c-Kit were used; however, a significant number of positive cells could not be obtained. SR-CM analyses of cryosections and cultured cells showed strong vimentin and F-actin positivity, with variable expression of α-SMA (α-Smooth Muscle Actin), α-actinin and cytokeratin. MSC markers and caveolin-1 were variably expressed, while CD34 was negative. PDGFR-α was strongly expressed in TLCs. c-Kit displayed punctate staining in the membrane and cytoplasm. These findings were supported by qRT-PCR analyses.

CONCLUSION: We identified TLCs with long and slender projections intermingled with collagen-synthesizing stromal cells with broader cytoplasm. These findings suggest a unique contribution to the literature by reporting, for the first time, the existence of TLCs in the hUC stroma and highlighting the cellular diversity within stem cell microniches.

FUNDING: Ankara University Scientific Research Fund, TYL-2024-3343.

Keywords: Interstitial cell, mesenchymal stem cell, telocyte, umbilical cord stroma

OP-0064 - Main Topics in Biological Sciences - Microscopy in Molecular and Cell Biology

Evaluation of miR-210, 146a-5p, 26a-5p, 223-3p, 155, and 93-5p expression in allograft tissues of patients with corneal rejection after transplantation

Gulam Hekimoğlu[1], Ece Turan Vural[2], Sibel Kuras[3], Kubra Sevgin[1], Hani Alsaadoni[4], Halime Hanim Pence[3]

[1]Department of Histology and Embryology, International Faculty of Medicine, University of Health Sciences, Istanbul, Turkey

[2]Ophthalmology Clinic, Haydarpasa Numune Education and Research Hospital, University of Health Sciences, Istanbul, Turkey

[3]Department of Medical Biochemistry, Faculty of Medicine, University of Health Sciences, Istanbul, Turkey

[4]Department of Medical Biology, International Faculty of Medicine, University of Health Sciences, Istanbul, Turkey

Corneal allograft rejection is an immune-mediated disease triggered by genetic background and environmental factors; however, there are still some gaps in understanding the mechanism of allograft rejection. Epigenetic mechanisms, including microRNAs (miRNAs), play an important role in the pathogenesis of corneal allograft rejection. These epigenetic mechanisms still need to be clarified. This study aimed to evaluate the expression of microRNA-210, 146a, 26a, 223-3p, 155, and 93-5p in corneal transplant tissue of corneal blindness patients. MicroRNA-210, 146a, 26a, 223-3p, 155, and 93-5p expressions in corneal tissues of patients who developed allograft rejection (n=20) and in corneal tissues of control that were procured for corneal transplants but were later found to be unsuitable for transplantation and were decided to be destroyed (n=20) were evaluated using real-time polymerase chain reaction (RT-PCR). Results demonstrated a significant downregulation of all six miRNAs in the rejection group compared to controls ($p<0,05$). In conclusion, this study highlights the potential involvement of miR-210, miR-146a, miR-26a, miR-223-3p, miR-155, and miR-93-5p in the immunopathogenesis of corneal allograft rejection and underscores the need for further investigation into their roles as diagnostic biomarkers or therapeutic targets.

Keywords: miRNA-210, 146a, 223-3p, 155, 93-5p, corneal allograft rejection

OP-0067 - Main Topics in Biological Sciences - Tissues and Systems

Alleviating effects of estrogen receptor activation in an indomethacin-induced gastric mucosal damage in rats

Sümeyye Güney[1], Sueda Tiryaki[1], Elif Çetine[1], Meryem Saifi[1], Rana Taşdemir[2], Elif Bahadır[3], Leyla Semiha Şen[4], Meral Yüksel[5], Berrak Ç. Yeğen[6], Feriha Ercan[2]

[1]School of Medicine, Marmara University, Istanbul, Turkiye

[2]Department of Histology and Embryology, School of Medicine, Marmara University, Istanbul, Turkiye

[3]Department of Physiology, School of Medicine, Bahçeşehir University, Istanbul, Turkiye

[4]Pendik Training and Research Hospital, General Surgery Clinic, Marmara University, Istanbul, Turkiye

[5]Medical Laboratory Program, Vocational School of Health Services, Marmara University, Istanbul, Turkiye

[6]Department of Physiology, School of Medicine, Marmara University, Istanbul, Turkiye

AIM: Peptic ulcer disease, which damages gastric and duodenal mucosae, is commonly caused by the use of nonsteroidal anti-inflammatory drugs and occurs less frequently in women. We aimed to investigate putative protective mechanisms of estrogen receptor (ER) activation in an indomethacin-induced ulcer model.

MATERIALS-METHODS: Male Sprague–Dawley rats (n=56) were subcutaneously injected with indomethacin (25 mg/ kg in 5% $NaHCO_3$), which was followed by injection of either 17β-estradiol (E2, 100μg/kg), E2+G-protein-coupled ER antagonist (G15, 300μg/kg), E2+ER-α antagonist (4,4′,4″-(4-Propyl-[1H]-pyrazole-1,3,5-triyl)trisphenol, 1mg/kg), E2+ER-β antagonist (diarylpropionitrile, 1 mg/kg), E2+ER-α-β antagonist (ICI 182,780, 1 mg/kg) or vehicle (DMSO and olive oil). Control group received 5% $NaHCO_3$ plus other vehicles. Two hours later, treatments were repeated. At the 4th hour, gastric serosal blood flow was assessed under ketamine+xylazine anesthesia. Following euthanasia with cardiac puncture, macroscopic damage scores were assessed. Histopathological semi-quantitative evaluation was performed on hematoxylin-eosin, mucus-secreting cells were evaluated in periodic acid-Schiff and mast cells were evaluated in toluidine blue stained sections. Luminal gastric surface was evaluated using scanning electron microscope. Results were analyzed using Kruskal-Wallis test and significance was accepted at the level of $p<0.05$.

RESULTS: Blood flow was decreased in all ulcer groups versus control ($p<0.05–0.0001$), but reduction was prevented in all E2-treated groups with respect to vehicle-treated ulcer group ($p<0.05–0.01$). Macroscopic damage scores were higher in all ulcer groups. Microscopic damage scores were increased in all ulcer groups compared to control group ($p<0.0001$). Compared with vehicletreated ulcer group, microscopic scores were lower in all E2treated groups ($p<0.05–0.0001$). Vehicle-treated ulcer groups showed decreased mucus-secreting cells, increased activated mast cells, while treatment with E2 alone or in combination with ER antagonist provided mild to moderate improvements.

CONCLUSION: Results showed that estrogen enhances peptic ulcer healing by increasing serosal blood flow and preserving mucosal integrity via the activation of either G-protein-coupled or nuclear receptors.

Keywords: Peptic ulcer, indomethacin, estradiol, estrogen receptors

OP-0075 - Main Topics in Biological Sciences - Tissues and Systems

Ceratonia siliqua protects testicular tissue in ischemia/ reperfusion injury

Şahika Yardım[1], Murat Dursun[2], İlayda Sözmen[3], Abdurrahman Fatih Aydın[3], Ateş Kadıoğlu[2], Ünal Uslu[4], Elif Kervancıoğlu Demirci[5]

[1]Department of Histology and Embryology, Istanbul University, Istanbul, Turkey;Department of Histology and Embryology, Istanbul Medeniyet University, Istanbul, Turkey; Başakşehir Çam ve Sakura City Hospital, Assisted Reproductive Treatment Center, İstanbul, Turkey

[2]Department of Urology, Section of Andrology, Istanbul University, Istanbul, Turkey

[3]Department of Biochemistry, Istanbul University, Istanbul, Turkey

[4]Department of Histology and Embryology, Istanbul Medeniyet University, Istanbul, Turkey

[5]Department of Histology and Embryology, Istanbul University, Istanbul, Turkey

INTRODUCTION: Testicular torsion is a urological emergency with a risk of resulting in loss of testicular function due to ischemia/ reperfusion injury (I/R) caused by oxidative stress. *Ceratonia siliqua* is known to decrease oxidative stress in urological pathologies. We investigated the protective effects of *C. siliqua* against I/R injury.

AIM: We aimed to apply intraperitoneal *C. siliqua* injection for 7 days and observe its effects histologically, biochemically, and ultrastructurally on the I/R model created in rat testicles.

MATERIALS-METHODS: Wistar rats (n = 28) were divided into control, i.p. *C. siliqua* injected, I/R injury group, and *C. siliqua* injected each day for a week after I/R groups. They were morphologically evaluated with light and electron microscopy, and Caspase-3, Hypoxia- inducible factor 1 alpha (HIF-1), CD68, Superoxide dismutase (SOD), and Catalase antibodies were marked. Oxidative stress markers of Glutathione (GSH), malondialdehyde (MDA), reactive oxygen species (ROS), advanced oxidation protein products (AOPP), and ferric reducing antioxidant power (FRAP) from tissue and levels of testosterone, Anti-Müllerian hormone (AMH) and inhibin-B from blood samples were examined.

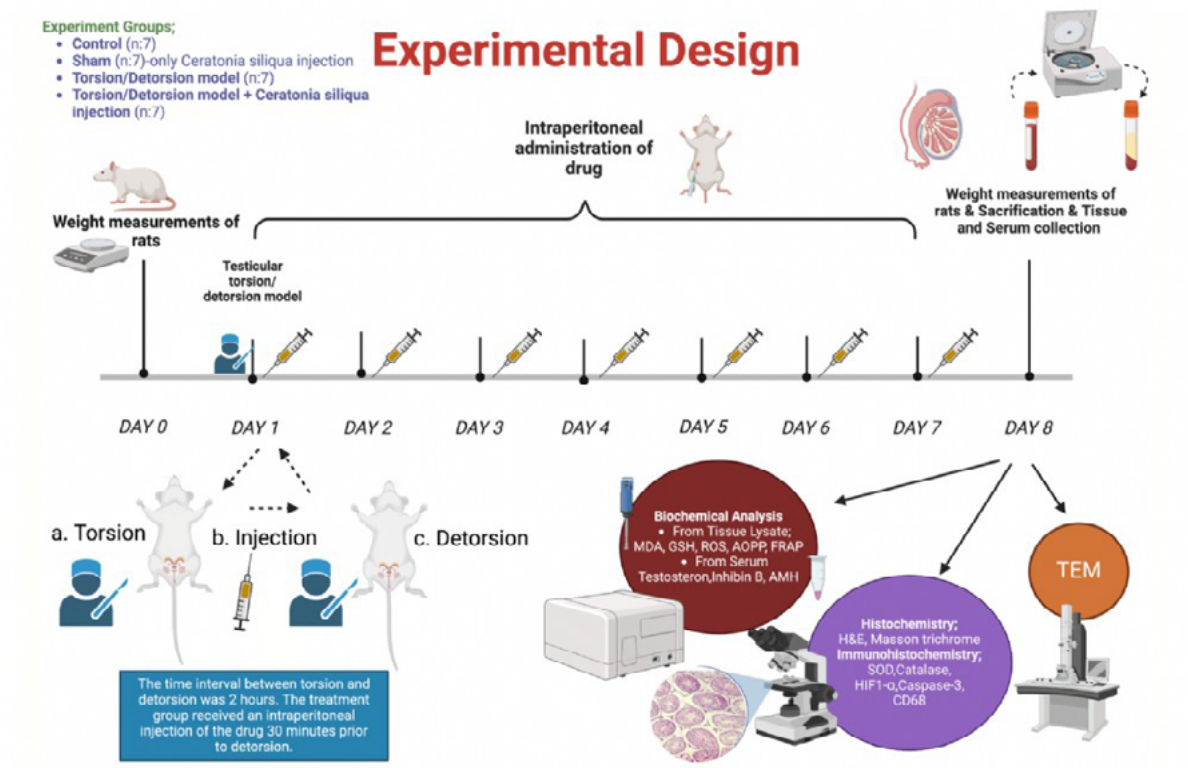
RESULTS: *C.siliqua* treatment preserved tissue integrity ($p<0.0001$) and Leydig cells and decreased apoptotic ($p=0.0390$) and necrotic changes when compared with the I/R group. The I/R group presented mitochondrial damage, intercellular edema, and vacuolization. Oxidative stress was less with treatment, but hormone levels were unchanged.

CONCLUSION: *C.siliqua* preserved the testicular tissue against I/R-induced damage. The decreased apoptosis may have been caused by the significant oxidative stress protection properties of *C.siliqua*. One week of treatment with *C. siliqua* protected Leydig cell morphology but did not change hormone parameters in the rat model. The therapeutic effect of *C.siliqua* is promising for clinical use in testis torsion cases.

This study was supported by Istanbul University Scientific Research Projects Unit. (project no. 39543).

Keywords: apoptosis, carob, oxidative stress, testicular torsion, testis

Figure 1. Experimental design



OP-0079 - Main Topics in Biological Sciences - Neurobiology

Protective Effects of Neuropeptide W on Cortex and Hippocampus of Rats Induced with Cerebral Ischemia/Reperfusion

Sena Eyüpreisoğlu[1], Ayşenur Çelik[1], Esra Kabasakal[1], Cansu Koçak[1], Damla Anıl Çelebi[2], Leyla Semiha Şen[3], Fazile Elif Bahadır[4], Meral Yüksel[5], Berrak Ç. Yeğen[6], Dilek Akakın[7]

[1]Marmara University, School of Medicine, İstanbul, Turkey

[2]İskenderun Technical University, Science and Technology Study and Research Center, Hatay, Turkey

[3]Marmara University, Pendik Training and Research Hospital, General Surgery Department, İstanbul, Turkey

[4]Bahçeşehir University, School of Medicine, Department of Physiology, İstanbul, Turkey

[5]Marmara University, Vocational School of Health Services, Department of Medical Services and Techniques, İstanbul, Turkey

[6]Marmara University, School of Medicine, Department of Physiology, İstanbul, Turkey

[7]Marmara University, School of Medicine, Department of Histology and Embryology, İstanbul, Turkey

AIM: Cerebral ischemia, a leading cause of disability and death, is caused by the occlusion of cerebral vessels leading to interrupted blood flow to the brain, resulting in oxygen and glucose deprivation and activation of inflammatory processes. The present study was aimed to investigate the short- and long-term neuroprotective effects of neuropeptide W (NPW) on cerebral ischemia-reperfusion injury in a rat model.

MATERIALS & METHODS: Male Wistar albino rats were anesthetized with ketamine-xylazine (100 mg/kg-10 mg/kg, intraperitoneally) and subjected to 30-minute occlusion of left common carotid artery (n=32), followed by reperfusion at 24th (short-term, STR) or 72nd hour (long-term, LTR). Sham-operated rats served as controls (n=14). Rats received subcutaneous saline or NPW (3 µg/kg) at the onset of reperfusion, and doses were repeated at 20th hour (STR) or twice daily (LTR). Neurological scoring, rotarod and locomotor activity tests were conducted before euthanasia. Neuronal damage was examined on cresyl violet-stained cortex and hippocampal sections and GFAP immunohistochemistry was applied. Oxidative stress markers, including malondialdehyde and reactive oxygen/nitrogen species (RONS) were measured. Data were analyzed using one-way ANOVA and Kruskal-Wallis tests.

RESULTS: In parallel with histological findings on cortical and hippocampal regions of the brain, neurological scores in the STR and LTR groups were decreased compared to respective control groups ($p<0.001$), whereas NPW treatment increased these scores. Similarly, decreased rotarod performance ($p<0.01$), and decreased locomotor activity in the LTR-ischemia group ($p<0.05$) were increased in the NPW-treated groups ($p<0.05$). Cerebral RONS and malondialdehyde levels were increased in the ischemia groups ($p<0.05$-0.001), while NPW decreased these levels ($p<0.01$-0.001).

CONCLUSION: Based on histological, biochemical and behavioral outcomes, NPW demonstrated a potent neuroprotective effect in both short- and long-term cerebral ischemia-reperfusion groups, suggesting NPW as a potential therapeutic agent for ischemia-related neurodegenerative diseases.

Keywords: Ischemia/Reperfusion, Cortex, Hippocampus, Neuropeptide W, GFAP

OP-0083 - Main Topics in Biological Sciences - Nanotechnology and Applications

Performance analysis of commercial superparamagnetic iron oxide nanoparticles for magnetic particle imaging-based mesenchymal stem cell tracking

Serbay Ozkan[1], Elena Ureña Horno[2], Reilteann Saul[1], Mahon Maguire[3], Harish Poptani[3], Marco Giardiello[2], Patricia Murray[1]

[1]Women's and Children's Health Department, Faculty of Health and Life Sciences, University of Liverpool, Liverpool, United Kingdom

[2]Department of Chemistry, University of Liverpool, Liverpool, United Kingdom

[3]Centre for Preclinical Imaging, University of Liverpool, Liverpool, United Kingdom

AIM: Magnetic Particle Imaging (MPI) is a cutting-edge, non-invasive technique with high sensitivity for real-time tracking of labelled cells. The performance of MPI critically depends on the properties of the superparamagnetic iron oxide nanoparticles (SPIONs) used for labelling. This study aims to evaluate the labelling efficiency, biocompatibility, internalization mechanism, and MPI performance of four commercial SPIONs—ProMag, VivoTrax, SynoMag-D, and Ferumoxytol—using mouse mesenchymal stem/stromal cells (MSCs).

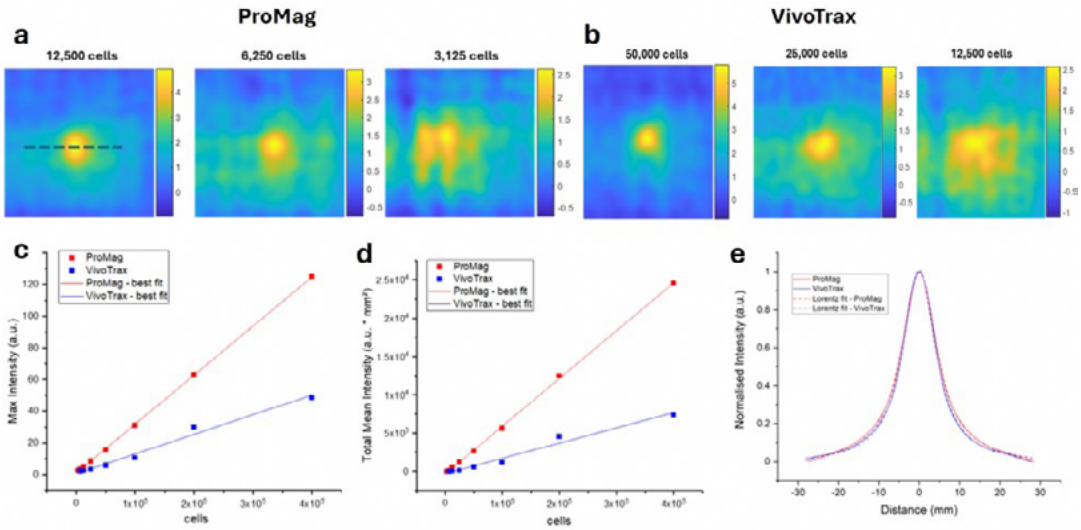
MATERIALS-METHODS: MSCs were expanded and labelled under optimized conditions with each SPION. Labelling efficiency was assessed via Prussian blue staining, and cytotoxicity via ATP-based viability assays. MPI was used to evaluate signal intensity, resolution, and detection sensitivity. SPION uptake was further analysed by inductively coupled plasma optical emission spectrometry (ICP-OES), transmission electron microscopy (TEM), and low-temperature inhibition assays to confirm internalization pathways.

RESULTS: ProMag achieved >90% labelling efficiency at 20 µg Fe/mL within two hours with minimal toxicity. VivoTrax required ≥240 µg Fe/mL for similar efficiency, but cell viability decreased, leading to an optimized dose of 120 µg Fe/mL. SynoMag-D and Ferumoxytol showed poor uptake without transfection agents and were excluded from further MPI analysis due to associated cytotoxicity. MPI signal intensity correlated linearly with cell number for both ProMag and VivoTrax ($r^2 = 0.99$). ProMag produced stronger signals and a lower detection limit (6,250 cells), attributed to higher iron content, while VivoTrax showed higher signal per iron unit, indicating superior magnetization. TEM confirmed internalization, with ProMag dispersed in the cytoplasm and VivoTrax localized in vesicular clusters. Endocytosis was validated as the main uptake mechanism via cold-temperature inhibition assays.

CONCLUSION: ProMag and VivoTrax are promising SPIONs for MPI-based MSC tracking, each with distinct advantages. Optimizing SPION selection and labelling protocols is crucial for effective and safe stem cell imaging in regenerative therapies.

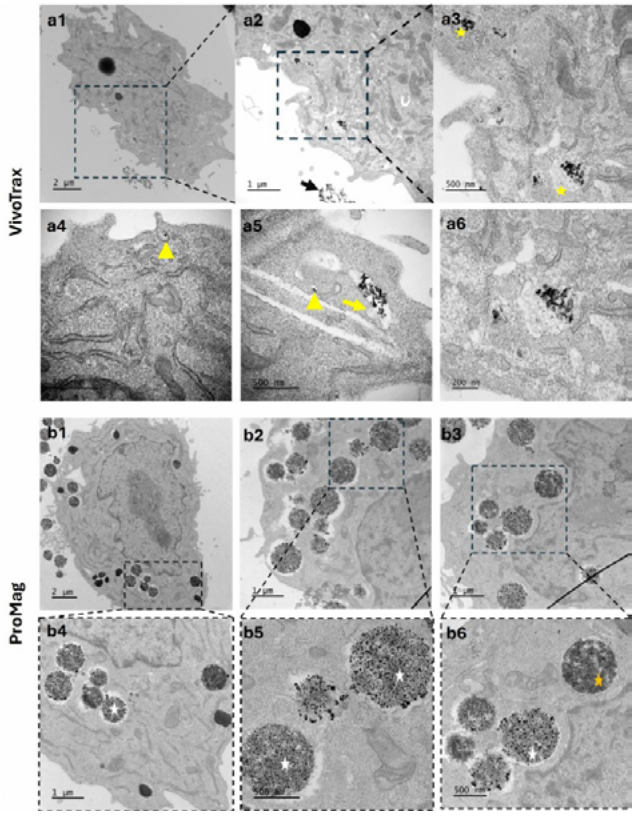
Keywords: Mesenchymal stem cells, superparamagnetic iron oxide nanoparticles, labelling, magnetic particle imaging, cell tracking

Figure-1



2D MPI images of cell labelled with ProMag (a) and VivoTrax (b). The taken images were analysed for two key sensitivity metrics: Maximum Intensity and Total Mean Intensity. Maximum Intensity was defined as the highest recorded signal within the dataset, while Total Mean Intensity was calculated by multiplying the mean MPI signal (a.u.) within the ROI by the area of the ROI (mm2). Resolution was estimated using the Full Width at Half Maximum (FWHM). Specifically, a profile line was drawn through the image along the axis of maximum signal intensity (see in [a]), using MagImage Image Analysis Software (Magnetic Insight). Expression of MPI signal as a function of cell number for ProMag (in red) and VivoTrax (in blue); Maximum intensity (c) and total mean Intensity (d) as a function of cell number, fitted Lorentzian curve fitting for resolution of labelled cells with either ProMag or VivoTrax (e).

Figure-2



Transmission electron microscopic evaluation of VivoTrax (a) and ProMag (b) labelled mMSCs. Yellow star: late endosomes including VivoTrax SPIONs; black arrow: unbound SPIONs; yellow arrow: early endosome fusing with vesicles containing SPIONs; yellow arrowhead: a particle encapsulated in vesicle (early endosome); white star: endocytosed ProMag particles; orange star: ProMag with granulated appearance.

OP-0087 - Main Topics in Biological Sciences - Tissues and Systems

Dose-dependent assessment of radiotherapy-induced ovarian damage in mice: differential gene expression profiling and ovarian function

İpek Yılmaz Düzgün[1], Rüya Sera Polat[1], Mehmet Eren Çiftçi[1], Ali Cihan Taşkın[4], Said İncir[3], Serçin Karahüseyinoğlu[2]

[1]Department of Reproductive Medicine, Koç University, Istanbul, Turkey

[2]Department of Histology and Embryology, Koç University, Istanbul, Turkey

[3]Department of Medical Biochemistry, Koç University, Istanbul, Turkey

[4]Department of Laboratory Animal Science, Istanbul University, Istanbul, Turkey

AIM: The aim of this study is to assess how different doses of pelvic irradiation affect ovarian follicle dynamics and uterine gene expression profiles in mice, as well as to identify potential systemic consequences, particularly in the liver.

MATERIALS-METHODS: CB6F1 female mice in the proestrus phase (n=6 per group) were subjected to pelvic X-irradiation via Xstrahl Cix2 Xray machine at doses of 4 Gy, 6 Gy, and 10 Gy. Ovarian, uterine, and hepatic tissues were analyzed. Gene expression was assessed via qPCR, along with histopathological examination and ELISA analyses. In addition, all follicle subtypes were counted to evaluate the effect of irradiation dose on ovarian reserve.

RESULTS: Out of 20 genes examined, in the 10 Gy group, AMH and LHR gene expression levels were significantly reduced ($p<0.05$), while a marked loss of primordial follicles was observed in the 6 Gy group. Aromatase expression was upregulated in the ovary at 6 Gy, and PR expression was significantly decreased in the uterus at 4 Gy. In the 10 Gy group, uterine Caspase-3 expression was elevated, while TNF-α levels and fibrotic changes were significantly increased in the liver ($p<0.05$). Additionally, in all irradiation dose groups, uterine CD31 expression was significantly decreased compared to the control group. Histological analysis revealed a significant reduction of primordial follicles at 6 Gy and notable collagen accumulation in the liver at 10 Gy.

CONCLUSION: The systemic and local effects of 6 Gy and 10 Gy doses show dose-dependent and tissue-specific variability. The mechanisms underlying ovarian reserve loss differ across doses. These findings indicate that pelvic radiotherapy exerts dose-dependent and tissue-specific effects, as evidenced by distinct patterns in differential gene expression, primordial follicle depletion, and histological alterations observed at varying irradiation doses.

Keywords: Ovarian Reserve, Pelvic Irradiation, Radiation-Induced Toxicity, Uterine Gene Expression, Histopathological Analysis

OP-0088 - Main Topics in Microscopy Techniques - Biomedical Applications of Microscopy

Interaction of mesoporous silica nanocarriers with photodynamic agents: microscopic analysis of morphology and intracellular distribution

Demet Sezgin Mansuroglu[1], Ayşe Işık[2], Seda Tarhan Şahin[1], Burcu Güleryüz Erkovan[3], Mustafa Kemal Ruhi[2]

[1]Center for Targeted Therapy Technologies, Boğaziçi University, Istanbul, Turkey

[2]Institute of Biomedical Engineering, Boğaziçi University, Istanbul, Turkey

[3]Department of Biomedical Engineering, Yeditepe University, Istanbul, Turkey

AIM: Mesoporous silica nanoparticles (MSNs) have emerged as promising carriers for photosensitizer (PS) delivery in photodynamic therapy (PDT). In this study, three widely used PSs (Rose Bengal (RB), Zinc Phthalocyanine (ZnPc), and Methylene Blue (MB)) were loaded onto MSNs and the influence of PS incorporation on nanoparticle morphology, surface charge, and cellular uptake in prostate cancer cells were evaluated.

MATERIALS-METHODS: Uniform MSNs were synthesized via a modified Stöber method using tetraethyl orthosilicate and cetyltrimethylammonium bromide. For PS loading, 2.4 mg MSNs were stirred with 2.4 mg of PSs in DMSO at room temperature for 24 h. Excess PS was removed by centrifugation, and loading efficiency was determined by spectrophotometer. Morphological changes in RB@MSN, ZnPc@MSN, and MB@MSN were examined by STEM. Surface charge was assessed by zeta potential. PC-3 cells were treated with 100 µg/mL formulations for 1 h; intracellular localization was visualized by confocal laser scanning microscopy leveraging PS fluorescence, with DAPI and phalloidin co-staining.

RESULTS: Unloaded MSNs were spherical, monodisperse (~70 nm), and well dispersed. PS loading induced partial aggregation and blurred boundaries, correlating with surface charge shifts (ZMSN = –21.4 mV; ZMB@MSN = +6.9 mV; ZRB@MSN = –19.6 mV; ZZnPc@MSN = –22.8 mV). High-resolution STEM revealed PS distribution within pores, with RB@MSN providing the greatest contrast. Confocal microscopy showed efficient nanoparticle internalization and predominant perinuclear localization in PC-3 cells for all three formulations.

CONCLUSION: This study demonstrates that STEM can effectively reveal the spatial distribution of photosensitizers within MSNs, and different PSs influence nanoparticle aggregation and surface charge factors that correlate with imaging contrast. Confocal analysis confirms successful cellular delivery and perinuclear accumulation of PS-MSNs.

Keywords: Mesoporous silica nanoparticles, Rose Bengal, Methylene Blue, Zinc Phthalocyanine, Scanning transmission electron microscopy (STEM), Confocal laser scanning microscopy

OP-0093 - Main Topics in Biological Sciences - Immunohistochemistry and Cytochemistry

Vitamin D supplementation in non-alcoholic fatty pancreas disease: insights from an experimental model of metabolic syndrome

Goksan Inci Durmaz[1], Duygu Aydemir[3], BURCU GUL[4], Betül Zorkaya[5], Nargiz Bayramova[2], Cigdem Bayram Gurel[2], Evrim Komurcu Bayrak[6], Fatma Kaya Dagistanli[2]

[1]Institute of Graduate Studies, Istanbul University - Cerrahpasa, Istanbul, Turkiye

[2]Department of Medical Biology, Cerrahpasa Faculty of Medicine, Istanbul University - Cerrahpasa, Istanbul, Turkiye

[3]Institute of Child Health, Department of Pediatric Basic Sciences, Division of Medical Genetics, Istanbul University, Istanbul, Turkiye

[4]Department of Medical Services and Techniques, Bezmialem Vakif University, Istanbul, Turkiye

[5]Aziz Sancar Institute of Experimental Medicine, Department of Genetics, Istanbul University, Istanbul, Turkiye

[6]Department of Medical Genetics, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkiye

AIM:
We investigated pancreatic and hepatic tissues in a rat model of metabolic syndrome (MetS) associated with non-alcoholic fatty pancreatic disease (NAFPD) (1), focusing on histopathological changes, metabolic pathways correlated with the potential therapeutic effects of Vitamin D (VitD).

MATERIALS-METHODS: Twenty-eight male Sprague Dawley rats were randomly assigned to four groups: Control (C), Metabolic Syndrome (MS), MS with Vitamin D treatment (MSD), and Control with Vitamin D (CD). The MS groups were fed a high-fat, high-fructose (HFHF) diet for 15 weeks to induce MetS. VitD-treated groups received oral supplementation for 12 weeks. Body weight, daily food and water intake, and fasting blood glucose were regularly recorded. Histological evaluations of pancreas tissues were performed using Hematoxylin-Eosin, Prussian Blue, and Masson Trichrome staining. Pancreatic expressions of insulin, glucagon, somatostatin, PDX1, VDR, γH2AX, p-NRF2, 8-OHdG, and Ki67 were assessed with immunohistochemistry. Serum insulin, hepatic oxidative stress markers, and iron accumulation were measured using ELISA. Statistical analyses were applied to all data obtained.

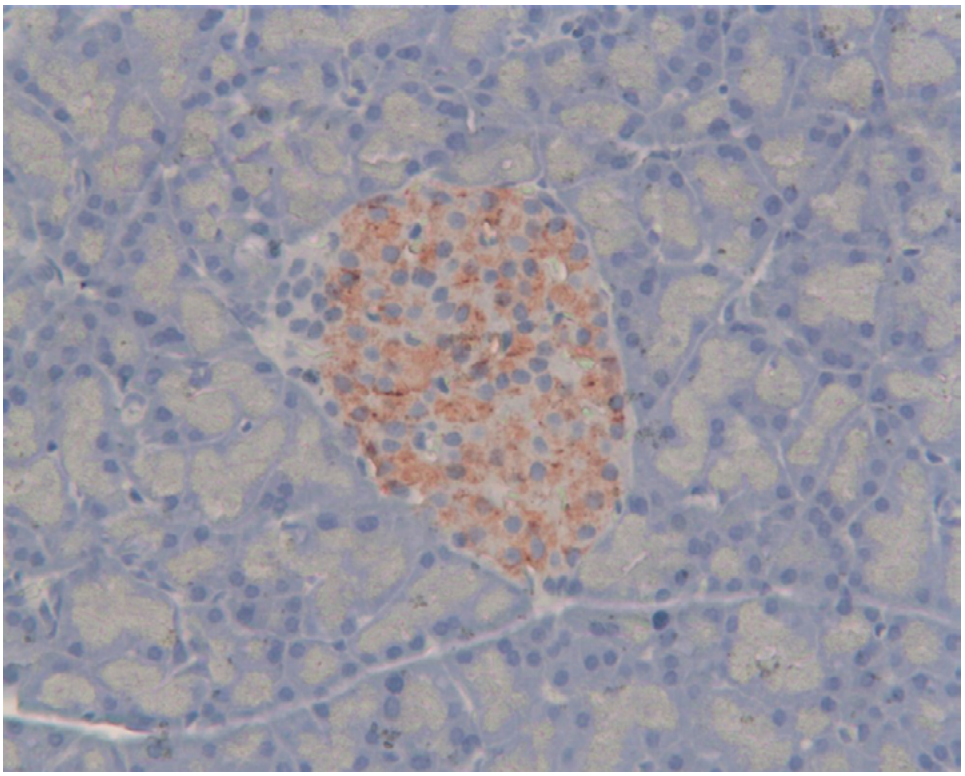
RESULTS: The MS group exhibited increased weight, fasting glucose, insulin levels, and caloric intake. Enlarged islets with irregular cell morphology and vacuolations were observed in both islets and acinar cells. Fibrosis and iron deposition were present in the pancreatic tissue. Although β-cell ratios were higher in MS islets than in controls, insulin immunoreactivity was weaker. MSD rats showed relatively more organized islet structure and increased insulin-positive cells, but MS groups had greater cell damage overall. Hepatic markers revealed reduced glutathione, elevated oxidized glutathione, and decreased glutathione peroxidase-4, especially in the MSD group.

CONCLUSION: MetS led to impaired glucose metabolism and islet hypertrophy as a compensatory response to increased insulin demand. The findings emphasize the destructive impact of MetS on pancreatic structure and function and VitD's potential therapeutic effects.

1. Pagkali, A., Diabetes, Metabolic Syndrome and Obesity, 2024, 17, 283–294.

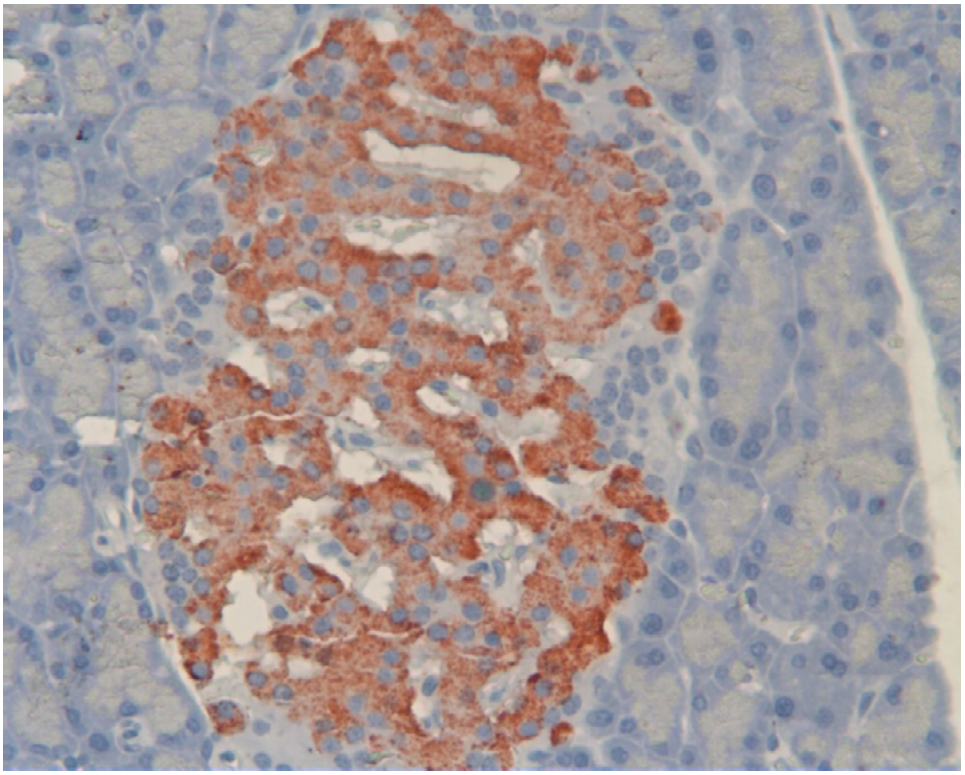
Keywords: Pancreas, Metabolic Syndrome, Vitamin D, NAFPD, High-Fat High-Fructose Diet

Figure 1



Immunohistochemical staining of pancreas tissue sections using insulin antibody. Control group Immunostaining: Streptavidin-biotin peroxidase. Magnification:x200.

Figure 2



Immunohistochemical staining of pancreas tissue sections using insulin antibody. Metabolic Syndrome group Immunostaining: Streptavidin-biotin peroxidase. Magnification:x200.

OP-0096 - Main Topics in Biological Sciences - Cancer Biology

Effect of Ribociclib, a CDK4/6 inhibitor, on ribosomal proteins RPL22L1 and FAU in glioblastoma cell lines

Pelin Süner[1], Ayşe Seda Akdemir[2], Zehra Sezer[3], Melek Öztürk[1]

[1]Medical Biology Department, Cerrahpasa Faculty of Medicine, Istanbul University-Cerrahpasa, Istanbul, Turkiye

[2]Medical Biology Department, Faculty of Medicine, Karabuk University, Karabuk, Turkiye

[3]Histology and Embryology Department, Cerrahpasa Faculty of Medicine, Istanbul University-Cerrahpasa, Istanbul, Turkiye

INTRODUCTION: Glioblastoma (GBM) is an aggressive brain tumor with a poor prognosis. Ribosome biogenesis is significantly upregulated in GBM and is tightly regulated by cell cycle control proteins. Targeting ribosome biogenesis has emerged as a potential therapeutic strategy in cancer. The ribosomal protein RPL22L1 is considered a potential oncogene due to its overexpression in aggressive GBM. The pro-apoptotic FAU protein is co-expressed with RPL22L1; however, their combined role in GBM pathogenesis remains unclear.

AIM: This study aimed to investigate the effects of the next-generation CDK4/6 inhibitor ribociclib on the expression of RPL22L1 and FAU in U87 and T98G glioblastoma cell lines, with a particular focus on its potential antitumor effects in therapy-resistant GBM.

MATERIALS-METHODS: The study groups were T98G-C and U87-C (untreated control groups), and T98G-R and U87-R (ribociclib-treated groups). Cell viability was measured using the MTT assay, and cell migration was assessed via the wound healing assay. Immunofluorescence staining was used to determine the expression and subcellular localization of RPL22L1 and FAU. Expression analysis was based on the percentage of immunopositive cells, including cytoplasmic and nuclear staining.

RESULTS: Ribociclib significantly reduced cell viability in both cell lines and markedly inhibited migration in T98G cells. Pathological nuclear changes—such as multinucleation, ring-shaped nuclei, chromatin condensation, fragmanted nuclei, and giant nuclei—were more prominent in the T98G-R group. Ribociclib treatment led to a significant decrease in RPL22L1 expression and a concomitant increase in FAU expression in both T98G-R and U87-R groups. RPL22L1 and FAU were localized in both the cytoplasm and nucleus, with FAU expression particularly elevated in apoptotic or degenerated cells compared to the T98G-C and U87-C groups.

CONCLUSION: This study provides preliminary evidence that ribociclib exerts differential effects on glioblastoma cell lines and may serve as a promising therapeutic strategy by modulating RPL22L1 and FAU expression.

Keywords: Glioblastoma, Ribociclib, Ribosomal Proteins, RPL22L1, FAU

OP-0099 - Main Topics in Microscopy Techniques - Sample Preparation Techniques

Qualitative assessment of physicochemical variables in classical Golgi and Golgi-Cox staining

Ekin Baysal[1], Esra Erdemli[2]

[1]Department of Histology and Embryology, Istanbul University Faculty of Medicine, Istanbul, Türkiye

[2]Department of Histology and Embryology, Ankara University Faculty of Medicine, Ankara, Türkiye

INTRODUCTION: Despite modern alternatives, silver-based Golgi and its mercury-derived variant, Golgi-Cox, remain widely used in neurohistology, though staining outcomes vary across laboratories.

AIM: To evaluate the impact of key physicochemical parameters on tissue penetration, staining selectivity, and morphological detail in classical Golgi and Golgi-Cox protocols.

METHODS: Wistar rat brains (n = 5) were processed using either classical Golgi or Golgi-Cox. Tested variables included block size, chromation conditions, pH, temperature, agitation, fixation (PFA, NBF, GA ± OsO_4), section thickness, and post-section treatment with ammonia–thiosulfate. Bright-field and TEM images were evaluated.

RESULTS: Golgi-Cox produced uniformly high contrast, clearly revealing dendrites and spines, whereas classical Golgi over-impregnated surface layers and left deeper regions under-stained, though axon bundles appeared prominent. Staining intensity in Golgi-Cox increased between days 2 and 14, then plateaued; further chromation produced artefacts. Block size had little effect, but subcortical labeling required ≥4 days. Agitation improved penetration in classical Golgi but disrupted Golgi-Cox surface staining. pH 4 favoured neurons and spines; pH 7 highlighted astrocytes; pH 8 yielded sparse labeling of vascular walls. Incubation at 37 °C accelerated staining, and 8% $K_2Cr_2O_7$ enhanced neuronal labeling. Golgi-Cox allowed neuronal visualization without prefixation, likely due to mercury's mild fixative effect, yet TEM revealed partial lysis despite preserved outlines. Aldehyde-based fixatives enhanced astrocytic labeling, often obscuring dendritic observation. Among them, glutaraldehyde preserved fine morphology best, and osmium addition improved axonal definition. Full dendritic reconstructions required 200 µm sections; 50–100 µm slices gave sharper general views. In Golgi-Cox, a 10 s ammonia dip plus thiosulfate clearing optimised contrast; longer treatments fragmented tissue. Ammonia was ineffective in classical Golgi, and thiosulfate removed silver precipitates. TEM confirmed neuronal cytoplasmic deposits at pH 4 and nuclear labeling of astroglial and endothelial cells at alkaline pH.

CONCLUSION: These practical benchmarks may guide optimization of Golgi-based protocols for specific neurohistological applications.

Keywords: Golgi-Cox impregnation, silver impregnation, protocol optimization, neurohistology, pH selectivity, physicochemical variables

OP-0106 - Main Topics in Material Sciences - Polymers and Organic Materials

Development and Evaluation of VEGF-Contained Polyhydroxyalkanoate (PHA) Scaffolds for Enhanced Peripheral Nerve Regeneration: A Comprehensive In Vitro, Ex Ovo CAM, and In Vivo Analyses

Dila Hatun Sal[1], Caroline Taylor[1], Jonathan Hinchliffe[1], Syed Mohammad Daniel Syed Mohamed[1], Annabelle Fricker[1], Kubilay Dogan Kılıc[2], Özde Şenol[3], Büşra Horuz[2], Burak Derkus[4], Hüseyin Biçeroğlu[3], John W. Haycock[1], Ipsita Roy[1,5]

[1]School of Chemical, Materials and Biological Engineering, Kroto Research Institute, The University of Sheffield, Broad Lane, Sheffield, S3 7HQ, UK;

[2]Faculty of Medicine Department of Histology and Embryology, Ege University, 35100, Bornova, Izmir, Türkiye;

[3]Department of Neurosurgery, Ege University, Faculty of Medicine, Izmir, Türkiye

[4]Stem Cell Research Lab, Department of Chemistry, Faculty of Science, Ankara University, 06560, Ankara, Türkiye

[5]INSIGNEO Institute, University of Sheffield, Sheffield, UK

AIM: To develop and evaluate VEGF-contained, PHA-based biomaterials to support peripheral nerve tissue (PNT) regeneration by promoting revascularization, Schwann cell (SCs) migration, and neuronal growth [1–3].
Results showed that VEGF-contained PHAs promote vascularization and nerve regeneration, supporting their potential in PNT repair.

MATERIALS-METHODS: VEGF was incorporated into 50:50 SCL-PHA:MCL-PHA blends at two concentrations via solvent casting. Angiogenic potential was assessed using the chorioallantoic membrane (CAM) model. Neuronal growth and cellular responses were evaluated via in-vitro studies with NG108-15 and primary SCs, while Dorsal Root Ganglion (DRG) cultures assessed cell-material interactions. In-vivo efficacy was tested in a mouse sciatic nerve injury model through functional recovery and histological outcomes. Bioactivity was assessed using NG108-15 neuronal cells and primary SCs. Viability and proliferation were analyzed by live/dead staining and resazurin assays. Neuronal growth and SCs were visualized via βIII-tubulin and S100β immunostaining. SEM assessed SCs adhesion. Mouse-DRG explants were cultured on biomaterials to evaluate axonal outgrowth and SCs migration. CAM assays in chick-embryos assessed angiogenesis. For in-vivo analysis, VEGF-loaded PHAs were fabricated into 3D-NGCs and implanted in a mouse sciatic nerve injury model. Regeneration was evaluated via SFI and histology.

RESULTS AND DISCUSSION: VEGF-contained PHA biomaterials promoted peripheral nerve regeneration and vascularization. In vivo, 3D NGCs with VEGF enhanced nerve repair and angiogenesis in a mouse sciatic injury model. Regeneration was assessed via CAM assay, SFI, histology, and VEGF ELISA. In vitro, NG108-15 and SCs showed increased growth and proliferation. SEM confirmed Schwann cell adhesion and morphology. Findings support their potential in nerve tissue engineering.

CONCLUSIONS: VEGF-contained PHA biomaterials enhanced neuronal growth, Schwann cell proliferation, and vascularization. SEM confirmed cell adhesion. CAM and in vivo assays showed accelerated nerve repair, supporting their potential for peripheral nerve regeneration.

Keywords: Polyhydroxyalkanoate, VEGF, Schwann cell, Peripheral nerve regeneration, natural polymer

OP-0115 - Main Topics in Biological Sciences - Immunohistochemistry and Cytochemistry

Effects of dapagliflozin on the reproductive system in aged male rats

Merve Cingöz[1], Selenay Furat[2], Gülşen Sönmez Çelebi[1], Yahya Kıransoy[3], Gökhan Duruksu[3], Semil Selcen Göçmez[1], Yusufhan Yazır[2], Tijen Utkan[1]

[1]Department of Pharmacology, Kocaeli University, Kocaeli, Turkey

[2]Department of Histology and Embryology, Kocaeli University, Turkey

[3]Department of Stem Cell, Kocaeli University, Turkey

AIM: Decreases in testosterone production, reduction in sperm count and viability, increased inflammation, and endothelial dysfunction are the primary consequences of the male reproductive system aging. Dapagliflozin is an oral antihyperglycemic agent and its effects are not limited to glycemic control but also include anti-inflammatory properties, reduction of oxidative stress, improvement of endothelial functions. This study aims to investigate the potential protective effects of dapagliflozin on age-related alterations in the male reproductive system and to compare these effects with those of metformin, another antihyperglycemic agent.

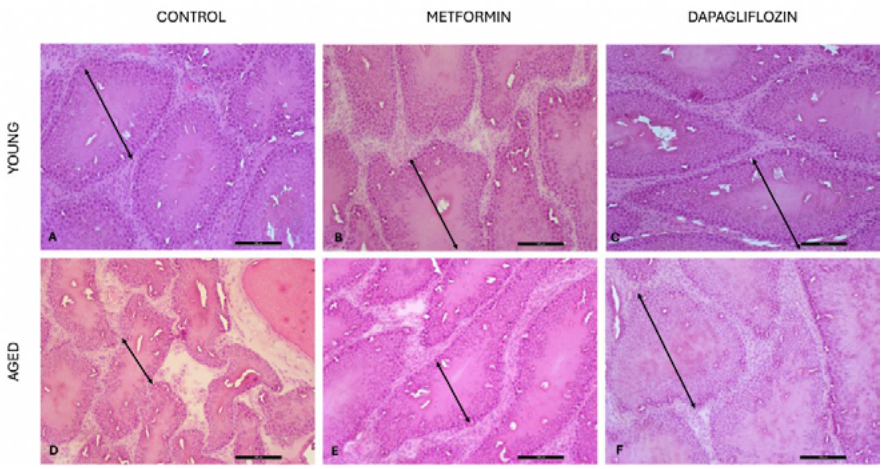
MATERIALS-METHODS: Young (4 months) and aged (12 months) rats were divided into 6 groups: Young Control, Young+Dapagliflozin, Young+Metformin, Aged Control, Aged+Dapagliflozin, and Aged+Metformin. Dapagliflozin (1mg/kg/day) and metformin (100mg/kg/day) were administered for 30 days. Following sacrifice, testicular tissues were isolated for RT-qPCR, histochemical (H&E) and immunohistochemical (PCNA) analyses. Serum testosterone and TNF-α levels were measured, and sperm viability was assessed using Eosin-Nigrosin staining.

RESULTS: Immunohistochemical analysis showed that PCNA expression levels in testicular tissues were significantly higher in the young control, metformin, and dapagliflozin groups compared to the aged control group. In aged animals, both drug treatments enhanced this expression levels. Sperm viability was high in young groups and markedly reduced in the aged control group; however, increased viability was observed in the aged metformin and dapagliflozin groups. Dapagliflozin elevated testosterone levels in young rats, though this increase was not statistically significant. In aged rats, a statistically significant increase was observed after dapagliflozin treatment when compared to aged control group. Serum TNF-α levels rise with aging, whereas both dapagliflozin and particularly metformin treatments significantly reduced these levels.

CONCLUSION: These findings indicate that dapagliflozin with multifaceted protective effects may offer potential therapeutic benefits for the male reproductive system beyond its role in glycemic control.

Keywords: Aging, male reproductive system, dapagliflozin, metformin

Figure 1



Effect of metformin and dapagliflozin administration on seminiferous epithelial thickness in young and aged groups. H&E, 200X magnification.

OP-0116 - Main Topics in Biological Sciences - Biomaterials and Tissue Engineering

Comparison of two treatment approaches for TAA-induced liver injury: Hydrogel injection or hydrogel integrated fibrous mesh implant

Gökçen Özgün[1], Gözde Ervin Köle[1], Samed Özer[6], Merve Antmen[4], Meltem Kolgazi[4], Deniz Yücel[5], Nurdan Tözün[3], Serap Arbak[2]

[1]Institute of Health Sciences, Department of Medical Biotechnology, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[2]School of Medicine, Department of Histology and Embryology Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[3]School of Medicine, Department of Gastroenterology, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[4]School of Medicine, Department of Physiology, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[5]Biomaterials R&D Center, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Türkiye

[6]Experimental Animal Application and Research Center, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

AIM: This study aims to compare two treatment approaches for liver regeneration, injection of mesenchymal stem cell (MSC) and melatonin loaded hydrogel solution or implantation of this hydrogel composition with fibrous mesh.

MATERIALS-METHODS: Hydrogel solution was prepared with collagen type I, melatonin and stem cell. For the implant, electrospun fibrous mesh and MSC-melatonin loaded hydrogel were combined. Meshes and hydrogels were examined with SEM. Mechanical properties of meshes was determined with tensile test. Degradation profiles of hydrogels were assessed gravimetrically. In *in vitro* studies, cell viability and morphology of Wharton's Jelly MSCs within hydrogels was investigated. In *in vivo* studies, a liver fibrosis rat model was established. For treatment, one group was ip injected with hydrogel-MSC-melatonin solution, while another group was implanted with MSC-melatonin loaded hydrogel integrated fibrous mesh. After 21 days of treatment, liver tissues were harvested, histopathological and ultrastructural evaluations were carried out.

RESULTS: The gelation occurred and hydrogel was formed at 37 °C. Degradation studies of hydrogel showed that 40% mass loss was observed within 24 h, reaching about 50% by day 30. The fibrous mesh consisted of submicron-scale fibers (500nm-3µm) and exhibited a Young's modulus of 10.37±2.33 MPa. Cell viability within the hydrogel determined with live/dead staining was 92.2%. Histopathological results showed that significant decrease in collagen fiber accumulation was detected in the implantation group, and a significant improvement was observed in inflammation and hepatocyte vacuolization. TEM results showed that nuclear structures of hepatocytes and morphology of bile canaliculi were largely preserved in the implant group, while endoplasmic reticulum expansion and degenerative changes due to vacuolization were reduced compared to other groups.

CONCLUSION: These findings indicate that the combination of fibrous mesh and MSC-melatonin loaded hydrogel particularly enhances tissue regeneration in liver fibrosis.

This study was supported by Acıbadem University Scientific Research Projects Commission (Project ID:2153).

Keywords: Biomaterials, histology, liver regeneration, scanning electron microscopy, transmission electron microscopy,

POSTER PRESENTATIONS

PP-03 - Main Topics in Biological Sciences - Pathology

Electron microscopic findings in three rare kidney diseases

Münevver Arslan[1], Banu Coskun Yilmaz[2], Yasemin Yuyucu Karabulut[3], Ahmet Kiykim[4], Kenan Turgutalp[4], Serap Demir[4]

[1]Bursa High Specialization Training and Research Hospital, Histology and Embryology, Bursa

[2]Mersin University, Department of Histology and Embryology, Mersin

[3]Mersin University, Department of Pathology, Mersin

[4]Mersin University, Department of Nephrology, Mersin

INTRODUCTION: Since renal diseases have very diverse etiologies and clinical presentations, diagnosis and treatment planning require a multidisciplinary approach. Electron microscopy is very important in detecting disease-specific findings that may be overlooked in light and immunofluorescence microscopic diagnosis.

AIM: The Electron Microscopy Laboratory of our department has been a reference laboratory where kidney biopsies have been routinely evaluated since 2005. Since we examine a large number of biopsies, cases of rare diseases are also included in our archives. Examining these diseases in a large number of samples as possible has the potential to produce important information, we aimed to examine cases of hemolytic uremic syndrome (HUS), Fabry disease and Alport syndrome.

MATERIAL-METHOD: Electron microscopic evaluations of adult patients referred to our laboratory in the 10-year period between 2013 and 2022 who were diagnosed with HUS, Fabry disease and Alport syndrome were examined.

RESULTS: Of the 1087 adult patients we examined in our laboratory during a 10-year period, 5 (0.45%) were diagnosed with HUS, 1 (0.09%) with Fabry disease, and 1 (0.09%) with Alport syndrome. Fenestrae loss and subendothelial lucent accumulation were observed in patients diagnosed with HUS. Myelin figure accumulations (zebra body) were observed in podocytes in the Fabry patient. In the patient diagnosed with Alport Syndrome, both thickening and thinning areas and basket appearance due to lamination were observed in the glomerular basement membrane (GBM). In addition, pedicel loss was observed in Fabry and Alport patients.

CONCLUSION: With this study, we have once again shown that electron microscopic examination has an important place in the diagnosis of diseases such as HUS, Fabry disease, and Alport syndrome. The fact that it guides the diagnosis of rare diseases with tissue examined directly without the need for special stains or preliminary diagnosis makes electron microscopy a very valuable diagnostic tool.

Keywords: Alport Syndrome, Electron Microscopy, Fabry Disease, Hemolytic Uremic Syndrome, Kidney Biopsy.

PP-04 - Main Topics in Biological Sciences - Pathology

Impression of Macrophage Migration Inhibitory Factor on autophagy in various types of lung cells of rat: electron microscopic study

Aygun Aliyarbayova, Nigar Quliyeva, Gulnara Sadiqova, Shahla Huseynova, Fidan İbrahimova, Ilaha Sadiqi, Leyla Yildirim

Department of Cytology, Embryology and Histology, Azerbaijan Medical University, Baku

INTRODUCTION: Autophagy is one of the main mechanisms that ensure homeostatic stability. "Macrophage Migration Inhibitory Factor" (MIF) is a cytokine that has multidirectional effect on inflammation.The ultrastructural manifestations of autophagy in lungs under MIF administration conditions have been insufficiently studied.

AIM: The aim of the research was to investigate electron microscopic study of autophagy in various cells of the lungs after MIF administration.

MATERIALS-METHODS: The study was conducted on 60 adult male Wistar albino rats subdivided into 3 groups:intact,placebo (saline injection) and main (administration of MIF (ProSpec CYT-193, Ness-Ziona)).Rats were anesthetized by ketamine, then lung tissue samples were taken 2 hours,2,3,7,15 and 30 days after injection.Obtained samples fixed,postfixed,dehydrated,embedded in Araldite-Epon blocks,sectioned and stained according to general methods on electron microscopic examination.Ultrastructural analysis was performed on JEM-1400 transmission electron microscope (Jeol,Japan).Autophagy was analyzed in 4 cell populations of the lungs:alveolar macrophages,stromal eosinophil leukocytes,tissue basophils,ciliated epithelial cells.The presence of at least 2 "lysosome - cytoplasmic component" complexes in the cytoplasmic plane was taken as a criterion for confirming autophagy.The proportion of "autophagy+" and "autophagy-" subpopulations in each population was calculated (%).The mean value of the indicator and its standard error (M±m) were determined at a confidence level of P=0.95 ($p<0.05$).

RESULTS: Ultrastructurally more pronounced manifestations of autophagy were noted in alveolar macrophages.During the experiment, the quantitative share of the "+" subpopulation was higher in the main group compared to the placebo group.After MIF administration,the general pattern within the group was as follows:stage I stimulation/induction of autophagy;stage II stabilization of autophagy and stage III inhibition of autophagy.When comparing stages I and II(p1), and then stages II and III(p2),the differences between the quantitative shares of the "+" subpopulation are statistically significant($p1< 0.05$; $p2< 0.05$).

CONCLUSION: Thus,the intensity and frequency of autophagy in different cell populations of white rat lungs changes in a stepwise manner after MIF injection:stimulation-stabilization-Inhibition.

Keywords: autophagy, lung, ultrastructure

PP-05 - Main Topics in Biological Sciences - Tissues and Systems

Investigation of the effects of L-Arginine on *"ex vivo"* treated left internal mammary artery (LIMA) grafts

Beste Dipcin[1], Ahmet Turan Keskintas[2], Gokcen Ozgun[3], Murat Ugurlucan[4], Bukem Tanoren[5]

[1]Department of Biomedical Engineering, Faculty of Engineering and Natural Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye

[2]Department of Molecular Biology and Genetics, Faculty of Engineering and Natural Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye

[3]Department of Medical Biotechnology, Institute of Health Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye

[4]Biruni University, Faculty of Medicine, Department of Cardiovascular Surgery, Istanbul, Türkiye

[5]Department of Natural Sciences, Faculty of Engineering and Natural Sciences, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye

INTRODUCTION: Cardiovascular diseases (CVDs) have one of the highest mortality in adults worldwide and are more common among males. Coronary artery bypass grafting (CABG) is a standard procedure performed for revascularization, saphenous vein, radial artery, and left internal mammary artery (LIMA) are used for the procedure. The most commonly used graft for CABG is LIMA thanks to its long-term patency, and increased survival from myocardial infarction. Although fibrosis and calcification of LIMA grafts are less compared to other grafts which lead to a decrease of graft patency or result in graft fail by calcification in long term. L-Arginine is a natural amino acid and the precursor of nitric oxide (NO) synthesis, which is a regulator of the vascular inflammation.

AIM: To understand the effects of L-Arginine on LIMA grafts' morphology, collagen content, elemental composition and whether it can be used to increase graft patency or not.

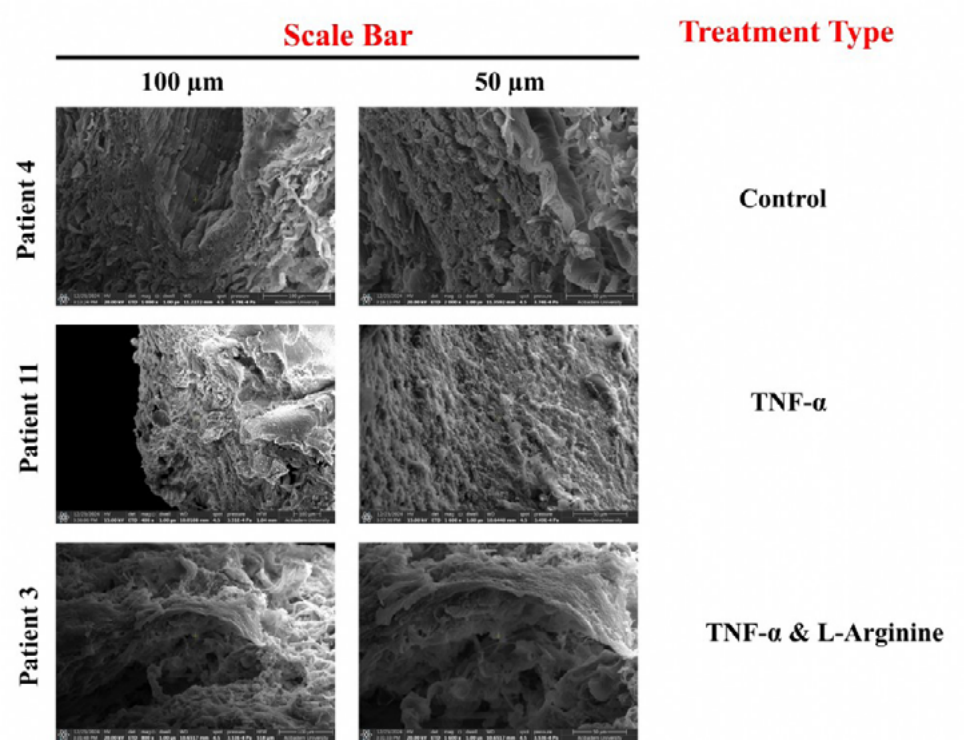
Materials & METHODS: In this study, LIMA grafts harvested from 18 male patients were treated *"ex vivo"* with either TNF-α or TNF-α & L-Arginine before cryosectioning. The cryosectioned tissue grafts were stained with hematoxylin & eosin (H&E) and Masson's Trichrome dyes and/or kits and were imaged with a brightfield microscope to observe the effects of the treatments on the grafts' morphology and collagen composition, respectively. The effects of the treatments on tissue morphology, and elemental composition were examined with scanning electron microscopy (SEM) imaging, and Elemental Dispersive Spectroscopy (EDS) analysis, respectively.

RESULTS: Results suggested the potential of L-Arginine for improving the LIMA graft patency since it improved graft morphology to be more organized, increased collagen deposition, decreased calcification and fibrosis regardless of the patient age.

CONCLUSION: This study overall suggested the potential usage of L-Arginine for improving the LIMA graft.

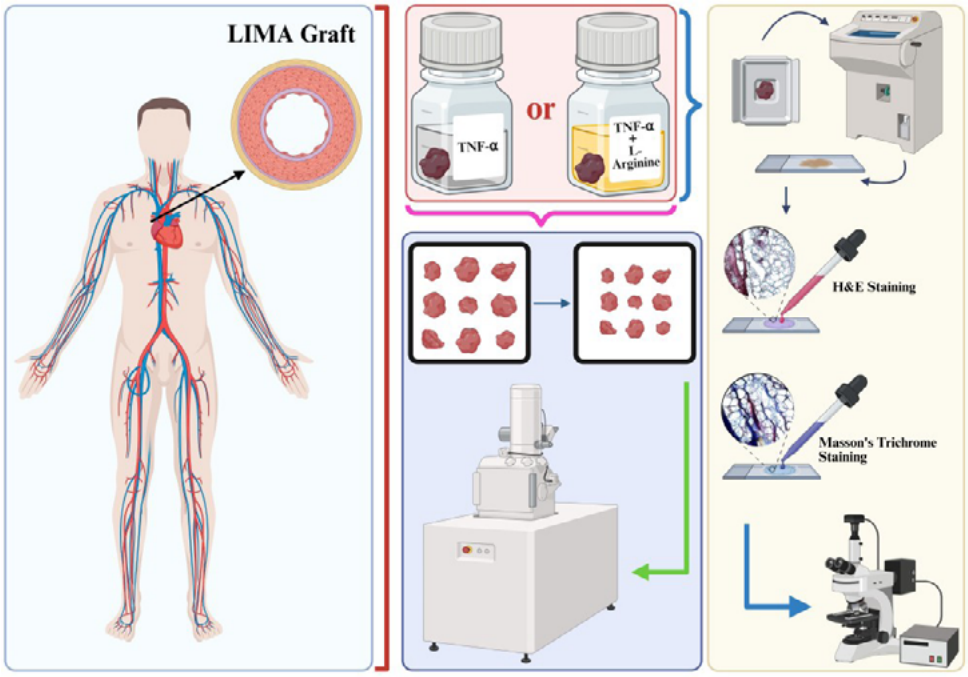
Keywords: Coronary artery bypass grafting, Graft patency, L-Arginine

LIMA graft SEM images of patients who are 70 years old



LIMA graft SEM images of patients who are around 70 years old with different magnifications with the patient numbers

Schematic representation of the methodology of the study



Methodology of the study represented in a figure (Created with Biorender.com)

PP-12 - Main Topics in Biological Sciences - Microscopy in Molecular and Cell Biology

Targeting inflammasome-mediated inflammation in psoriasis: Loganin as a novel iridoid glycoside-based therapeutic strategy

Cafer Tas[1], Eda Acikgoz[1], Mustafa Cakir[2], Seda Keskin[1]

[1]Department of Histology and Embryology, Faculty of Medicine, Van Yuzuncu Yil University, Van, Turkiye

[2]Department of Medical Biology, Faculty of Medicine, Van Yuzuncu Yil University, Van, Turkiye

INTRODUCTION: Psoriasis is a multifactorial, chronic inflammatory skin disease characterized by epidermal hyperproliferation, keratinocyte differentiation abnormalities, and immune system dysfunction. The NLRP3 inflammasome complex has emerged as a key regulatory element in the pathogenesis of the disease. Current treatment options are often limited by reduced long-term efficacy and undesirable side effects, underscoring the need for novel molecular targets.

OBJECTIVE: This study sought to assess the therapeutic efficacy of Loganin (LOG), a natural iridoid glycoside, in an imiquimod (IMQ)-induced psoriasis mouse model.

MATERIALS& METHODS: Thirty-five BALB/c mice were randomly assigned to five groups: control, saline+vaseline (SAL+VAS), LOG, IMQ, and IMQ+LOG. Psoriatic inflammation was elicited by daily topical administration of IMQ for seven consecutive days. The severity of the disease was evaluated utilizing the Psoriasis Area and Severity Index (PASI). Histopathological and morphometric changes were examined through H&E and Masson's trichrome staining, alongside volumetric assessment using the Cavalieri method. mRNA expression levels of NLRP3, ASC, caspase-1, IL-1β, gasdermin, TNF-α, and IL-17A were quantified via qPCR, and serum cytokine levels of IL-1β and IL-17A were measured using ELISA. NLRP3, ASC, caspase-1, and IL-1β expressions were assessed by immunohistochemistry. Furthermore, immunofluorescence staining for PCNA, CK-17, and VEGFR2 was measured utilizing ImageJ.

RESULTS: LOG treatment significantly improved epidermal thickness, lymphocytic infiltration, collagen density, and vascularization.
Immunohistochemical findings demonstrated a significant reduction in the expression of NLRP3, ASC, caspase-1, and IL-1β proteins. Consistently, qPCR results demonstrated downregulation of inflammasome-related genes and proinflammatory cytokines. Furthermore, immunofluorescence intensities of PCNA, CK-17, and VEGFR2 were significantly reduced. LOG also decreased serum levels of IL-1β and IL-17A, signifying a reduction in the systemic inflammation.

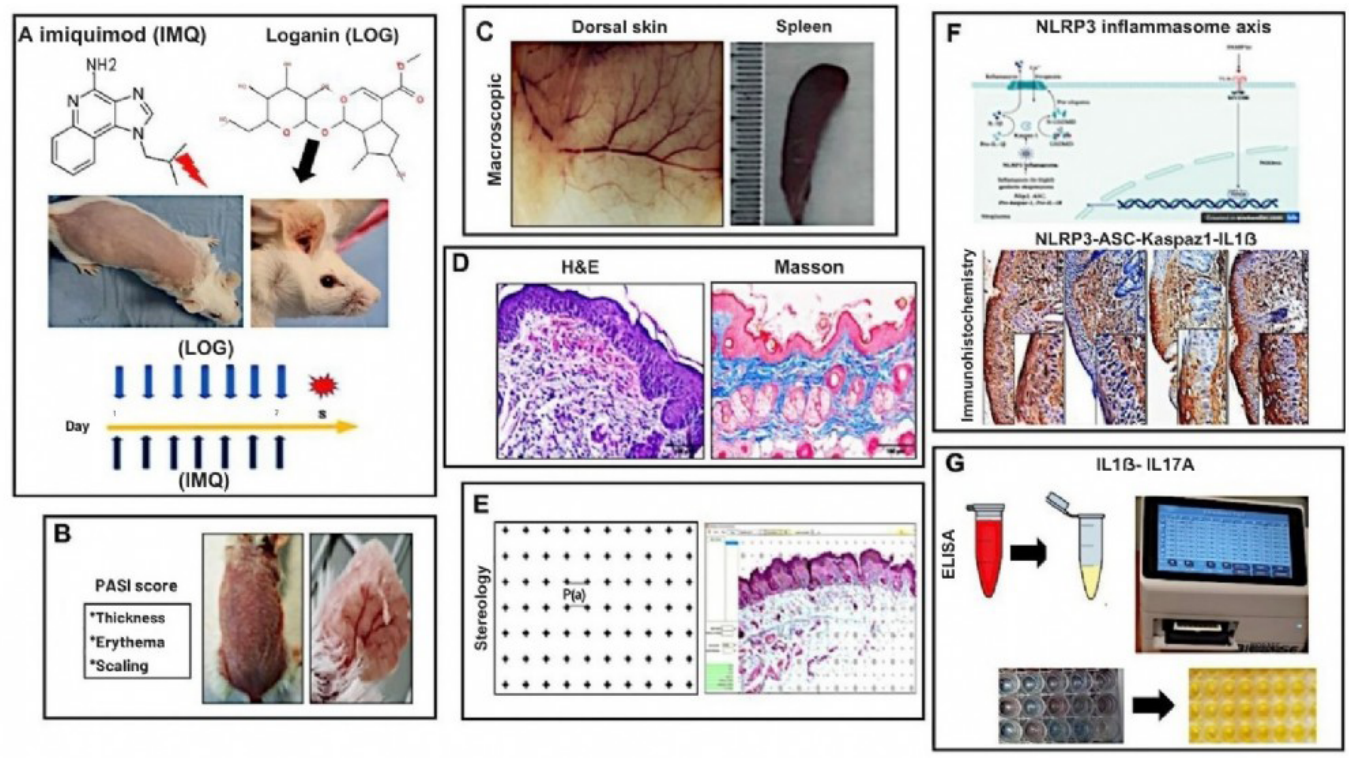
CONCLUSION: The results revealed that LOG exhibits considerable anti-inflammatory effects via inhibiting NLRP3 inflammasome activation and associated inflammatory pathways. LOG may serve as a new candidate for future anti-psoriatic therapeutics focused on inflammasome-mediated cutaneous inflammation.

Keywords: Imiquimod, Psoriasis, Loganin, Inflammation, NLRP3 inflammasome

Acknowledgement

This study was supported by the Scientific Research Projects Unit of Van Yuzuncu Yil University under project number TYL-2022-9889 and by TÜBİTAK under module 1002-B with code 123S046.

Experimental design and methods



A) Establishment of an in vivo psoriasis model, B) Evaluation of model formation using the PASI score, C) Macroscopic changes in the dorsal skin and spleen, D) Histopathological evaluation, E) Stereological analysis of the epidermis and dermis layers, F) Immunohistochemical analysis of NLRP3 inflammasome signalling pathway components, G) Determination of IL-1β and IL-17A levels in serum using ELISA.

PP-13 - Main Topics in Biological Sciences - Microscopy in Molecular and Cell Biology

The Potential Role of the Hippo Signaling Pathway and Telomerase Activity in Circadian Rhythm-Associated Uterine Alterations in Mice

Elaza Aliyeva, Aylin Yaba

Department of Histology and Embryology, Yeditepe University, Istanbul, Turkey

The circadian rhythm regulates numerous physiological processes in mammals, including the female reproductive system. Emerging evidence highlights the necessity of synchronized core circadian clock genes for reproductive health, as disruptions in the light-dark cycle can impair maternal sleep, embryonic development, and fetal maturation. Based on this, we hypothesized that the uterine circadian clock may be regulated by the Hippo signaling pathway and telomerase activity.

To test this, we examined the expression of Hippo pathway components and mTERT (mouse Telomerase Reverse Transcriptase) in the uterine tissue of mice subjected to circadian rhythm disruption. 20 female Balb/C mice (6–8 weeks old) were divided into control and experimental groups (n=10). The control group was kept under a 12:12 hour light/dark (LD) cycle, while the experimental group was exposed to continuous light (LL) for one week.

After the experimental period, uterine tissues collected. The right uterine horn was used for morphological and immunofluorescence analysis, and the left horn for quantitative real-time PCR (qRT-PCR). Immunofluorescence localized PER2, YAP1, TEAD4, and mTERT proteins. Gene expression of YAP1, TEAD4, mTERT, and circadian regulators (BMAL1, CLOCK, PER2, CRY) was analyzed by qRT-PCR. Data were analyzed using ImageJ and GraphPad Prism; $p<0.05$ was considered significant.

Morphological analysis revealed that the experimental group exhibited a significant reduction in luminal epithelial thickness and myometrial thickness, alongside increased numbers of endometrial glands and luminal diameter. Immunofluorescence revealed elevated YAP1 and TEAD4 and reduced mTERT expression. At the mRNA level, only CRY was significantly increased, while mTERT was significantly decreased in the LL group.

In conclusion, circadian disruption may alter uterine physiology via the Hippo pathway and telomerase regulation. These findings suggest Hippo signaling may locally regulate uterine circadian mechanisms particularly under conditions of circadian misalignment, and could serve as a target in circadian-related infertility.

Keywords: Circadian rhythm, Hippo signaling pathway, mTERT, Uterus.

PP-16 - Main Topics in Biological Sciences - Neurobiology

Glutamatergic Regulation of R-spondin1-Expressing Hypothalamic Neurons Under Physiological Conditions

Nursel Hasanoglu Akbulut[1], Duygu Gök-Yurtseven[2], Gonca Topal[2], Özhan Eyigör[2]

[1]Department of Histology and Embryology, Canakkale Onsekiz Mart University, Faculty of Medicine, Canakkale, Turkey

[2]Department of Histology and Embryology, Bursa Uludag University, Faculty of Medicine, Bursa, Turkey

AIM: Food intake is regulated by hypothalamic neuropeptides and neurotransmitters. RSPO1, a secreted protein, is expressed in energy-related hypothalamic nuclei. The glutamatergic system, a key excitatory pathway in the hypothalamus, regulates neuroendocrine responses. This study examined whether RSPO1 neurons in the supraoptic (SON), paraventricular (PVN), and arcuate (ARC) nuclei are activated by refeeding or glucose and suppressed by glutamatergic antagonists.

MATERIALS-METHODS: Sprague Dawley rats (n=70; 35 males, 35 females) were divided into experimental groups: fasting control, refeeding, CNQX (2 mg/kg, i.p.) + refeeding, glucose (2 g/kg, i.p.), CNQX + glucose, and MK-801 (1 mg/kg, i.p.) + glucose. Animals were sacrificed via transcardial perfusion and 40 µm coronal brain sections were obtained. RSPO1/c-Fos double immunolabeling was performed, and the percentage of activated RSPO1 neurons was quantified in SON, PVN, and ARC. Plasma RSPO1 concentrations were measured using ELISA.

RESULTS: The percentage of activated RSPO1 neurons in SON, PVN, and ARC was respectively calculated as: fasting (♂4.61%, 15.76%, 11.57; ♀2.81%, 4.63%, 17.23%), refeeding (♂93.71%, 84.21%, 8.49; ♀93.71%, 48.93%, 20.57%), and CNQX+refeeding (♂28.02%, 10.62%, 11.18; ♀28.02%, 7.14%, 10.72). Glucose significantly increased RSPO1 activation in the SON and PVN ($p < 0.001$), and this increase was suppressed by CNQX or MK-801. In female rats, glucose-induced RSPO1 activation in the ARC was more limited compared to the other regions. ELISA results in male rats showed that RSPO1 levels significantly increased following feeding and glucose administration after fasting, and this increase was notably suppressed by antagonist treatments ($p< 0.05$).

CONCLUSION: The results demonstrate that RSPO1 activation is dependent on glutamatergic signaling and also reveal sex-specific differences, which are supported peripherally by ELISA findings. It is suggested that the anorexigenic effects of RSPO1 may be modulated by the glutamatergic system in the hypothalamus.
Supported by TÜBİTAK (Project No: 123S881).

Keywords: Feeding, Glucose, Glutamate, Immunohistochemistry, Neuronal Activation, RSPO1

PP-17 - Main Topics in Biological Sciences - Tissues and Systems

The diagnostic and prognostic role of free fatty acid binding protein in peripheral arterial disease

Pınar Koroglu[1], Helin Abiri[2], Muhammed Zeki Damaksız[2], Zeynep Rüveyda Karaçayır[2], Barış Can Kayan[2], Ali Kubilay Korkut[3]

[1]Department of Histology and Embryology, Faculty of Medicine,Halic University, Istanbul, Turkey.

[2]Faculty of Medicine, Halic University, Istanbul, Turkey.

[3]Department of Cardiovascular Surgery, Faculty of Medicine, Halic University, Istanbul, Turkey

AIM: Peripheral arterial disease is known to occur as a result of a complex inflammatory and fibroproliferative response involving the accumulation of lipoproteins in the intima layer of the arterial wall and the adventitia layer. Fatty acid-binding protein 3 (FABP3) is part of the multigene family of fatty acid-binding proteins, which are expressed mainly in skeletal and cardiac muscle. Although FABP3 has been shown to have an effect in many areas, no study has been found showing its relationship with different parameters in peripheral artery disease. In this study, we investigated the relationship between the fatty acid binding protein parameter and peripheral artery disease in the blood samples.

MATERIALS-METHODS: In our study, blood samples taken who applied to cardiovascular surgery were considered. Group 1 (n: 30) - control group - healthy individuals, Group 2 (n: 30) - individuals diagnosed with peripheral arterial disease. FABP3 parameter was evaluated by ELISA (Enzyme-Linked ImmunoSorbent Assay) method. The relationship between the groups with biochemical parameters (low-density lipoprotein (LDL), cholesterol, high-density lipoprotein (HDL) and glycated hemoglobin (HbA1c) was considered. In blood samples, peripheral smears were analyzed to determine the distribution of blood elements and to identify correlations. All data were analyzed by statistically.

RESULTS: In peripheral artery disease, LDL, cholesterol, HDL, HbA1c, inflammation in peripheral smear samples and FABP3 levels were found to be higher compared to the control group. The correlation effect of multiple factors on peripheral artery disease in terms of early diagnosis is another parameter in our study. FABP affects cardiovascular status at both serum level and light microscopic levels. Individuals with higher serum concentrations of FABP are more likely to develop peripheral arterial disease.

CONCLUSION: This study highlights the potential prognostic value of FABP3 in identifying and managing peripheral artery disease paving the way for more integrated diagnostic approaches.

Keywords: Peripheral arterial disease, FABP3, lipoprotein, inflammation, biomarker.

PP-18 - Main Topics in Biological Sciences - Microscopy in Molecular and Cell Biology

Rotenone-induced mitochondrial dysfunction is associated with changes in mTORC1-mediated translational pathways in human granulosa cells

Elif Kılıç, Beyza Gaye Edepli, Aylin Yaba
Department of Histology and Embryology, Yeditepe University, İstanbul, Turkey

INTRODUCTION: The mechanistic target of rapamycin (mTOR) signaling pathway is crucial in granulosa cells for regulating cell growth, proliferation, and metabolism, which are essential for follicular development and oocyte maturation. Key downstream effectors of mTOR include 4E-BP1 (eIF4E-binding protein 1), a translational repressor, and eIF4E (eukaryotic initiation factor 4E), which initiates mRNA translation by binding to the 5′ cap structure. The balance between 4E-BP1 and eIF4E modulates protein synthesis, impacting granulosa cell proliferation, survival, and steroidogenesis. This study aimed to investigate the relationship between mitochondrial integrity and the expression of mTOR downstream proteins 4E-BP1 and eIF4E in human non-luteinized granulosa cells (HGrC1).

MATERIALS and METHODS: Mitochondrial function was disrupted using rotenone, a selective inhibitor of mitochondrial complex I known to impair ovulation and fertilization and inhibit mTORC-mediated signaling. HGrC1 cells were treated with rotenone (3 µM), DMSO (vehicle), and untreated control for 24 hours. Cell viability was measured using automated counting, migration was assessed by wound healing assay, and mitochondrial membrane potential was evaluated with MitoTracker Red CMXRos staining. Immunofluorescence for ATP5H (a mitochondrial marker), 4E-BP1, and eIF4E was performed and quantified using confocal microscopy (Zeiss LSM780) and image analysis (ImageJ/Fiji).

RESULTS: Rotenone treatment significantly reduced granulosa cell viability ($p = 0.0001$) and migration compared to controls ($p = 0.002$). While total fluorescence intensities of eIF4E and 4E-BP1 were not significantly changed, rotenone induced perinuclear clustering of mitochondria, indicating impaired mitochondrial dynamics. Notably, there was an increased nuclear-to-cytoplasmic ratio of eIF4E in cells exhibiting nuclear abnormalities, suggesting altered translational regulation. ATP5H expression decreased, confirming mitochondrial impairment.

CONCLUSION: In conclusion, rotenone-induced mitochondrial dysfunction compromises granulosa cell viability and migration, disrupts mitochondrial dynamics, and alters subcellular localization of eIF4E, highlighting the critical role of mitochondrial integrity in modulating mTOR downstream effectors and translational control. These changes may impact follicular development and oocyte quality.

Keywords: mTOR pathway, HGrC1, mitochondrial dysfunction

PP-20 - Main Topics in Biological Sciences - Neurobiology

In Vitro Effects of Targeted and Temozolomide Loaded Human Serum Albumin Nanoparticles on Glioblastoma

Hakan Sahin[1], Oguz Yucel[2], Eren Yildirim[2], Serkan Emik[2], Gulten Gurdag[2], Gamze Tanrıverdi[1], Gozde Erkanli Senturk[1]

[1]Department of Histology and Embryology, Cerrahpasa Faculty of Medicine, Istanbul University-Cerrahpasa, Istanbul, Turkey

[2]Department of Chemical Engineering, Faculty of Engineering, Istanbul University-Cerrahpasa, Istanbul, Turkey

AIM: Glioblastoma is an aggressive primary brain tumor with a poor prognosis, despite advancements in surgical resection, radiotherapy, and chemotherapy most notably with temozolomide (TMZ). In this context, nanoparticles (NPs) have emerged as promising candidates for novel therapeutic strategies. Human serum albumin (HSA), a biocompatible, biodegradable, and non-immunogenic protein, has the ability to bind various active substances, making it a suitable carrier for NP-based drug delivery in clinical applications.

MATERIALS-METHODS: In this study, human serum albumin (HSA) nanoparticles (NPs) loaded with temozolomide (TMZ) (TMZ&NP) were synthesized. To enhance glioblastoma targeting, the NPs were conjugated with folic acid (FA), transferrin (Tf), or atherosclerotic plaque (AP) ligands. The therapeutic efficacy of these NP formulations was evaluated using both two-dimensional (2D) and three-dimensional (3D) in vitro glioblastoma models, employing the C6 rat glioblastoma cell line.

RESULTS: Nanoparticles (NPs) labeled with gold nanoparticles (AuNPs) were detected in the cytoplasm of C6 glioma cells using the silver enhancer method under light microscopy. TMZ&NPs induced significantly higher cytotoxicity compared to TMZ (400 µM, 48 hours), with effects varying depending on the type of ligand. TMZ, TMZ&NP, and TMZ&NP-FA significantly inhibited the growth of C6 spheroid diameters ($p < 0.05$). In contrast, TMZ&NP-Tf and TMZ&NP-AP did not inhibit spheroid growth, as the diameters were comparable to those of the control and TMZ-treated groups. Additionally, TMZ, TMZ&NP, and TMZ&NP-AP significantly increased the number of cleaved caspase-3–positive cells within the spheroids, indicating enhanced apoptosis ($p < 0.05$).

CONCLUSION: This study highlights the potential of actively targeted NP systems as effective tools for glioblastoma treatment. The findings underscore the importance of ligand-mediated targeting in enhancing therapeutic outcomes. Further research is needed to evaluate the safety and efficacy of these NP formulations in human glioblastoma models.

Keywords: Glioblastoma, C6 Cell Line, Nanoparticle

PP-22 - Main Topics in Biological Sciences - Tissues and Systems

Radioprotective effect of Myrtus communis on kidney bladder and ovary tissues in rats: TROD-GROG-004

Selnur Özkurt[1], Bedriye Doğan[2], Nagehan Özyılmaz[3], Aslı Aykaç[4], Büşra Ertaş[5], Ali Şen[6], Cemile Ceylan[7], Feriha Ercan[8], Beste Melek Atasoy[9]

[1]Istanbul University Oncology Institute, Department of Radiation Oncology

[2]İnönü Üniversity, Department of Radiation Oncology

[3]Samsun University Faculty of Medicine, Department of Histology and Embryology

[4]Near East University, Department of Biophysics

[5]Marmara University Faculty of Pharmacy, Department of Pharmacology

[6]Marmara University Faculty of Pharmacy, Department of Pharmacognosy

[7]Yeditepe University Institute of Health Sciences

[8]Marmara University Faculty of Medicine, Department of Histology and Embryology

[9]Marmara University Faculty of Medicine, Department of Radiation Oncology

We investigated the radioprotective effect of Myrtus communis in kidney, bladder, and ovarian tissues. Female rats (n=30) were divided into four groups. The control group (C) (n=6) received only oral saline (SF) for four days. Ionizing radiation (IR) groups were organized as "IR group (IR)" (n=8) received oral SF for four days starting on the day of administration; "MC treatment group (MC-tx)" (n=8) received oral MC for four days beginning on the day of irradiation, and "MC pretreatment group (MC-Ptx)" (n=8) received oral MC for a total of eight days starting four days before irradiation. MC was administered by oral gavage. Irradiation was performed as 10 Gy in a single fraction. On the fourth day of irradiation, all rats were sacrificed, the tissues were examined histopathological, and Caspase-9 and Caspase-3 levels were examined using western blotting to assess mitochondrial apoptosis. Radiation-induced damage decreased in all treatment groups. Caspase-9 and Caspase-3 levels were significantly decreased in the MC-Ptx and MC-tx compared to the IR in all tissues ($p<0.01$). Myrtus communis significantly ameliorated the inflammatory effects of ionizing radiation in the kidney, bladder, and ovary, which may open new possibilities for novel radioprotective strategies.

Keywords: bladder, kidney, Myrtus communis, ionizing radiation, rat, ovary

Figure 1: Kidney

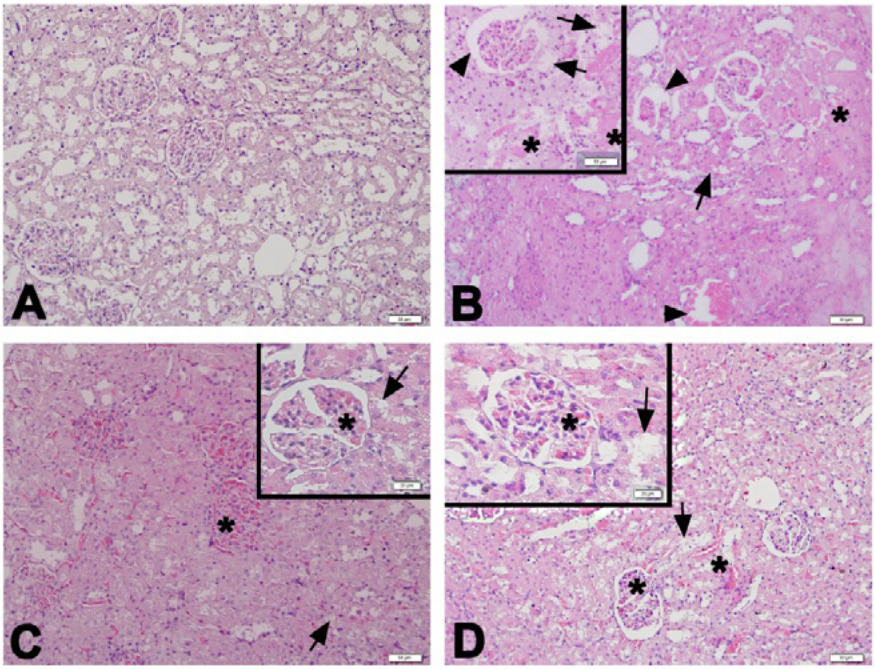
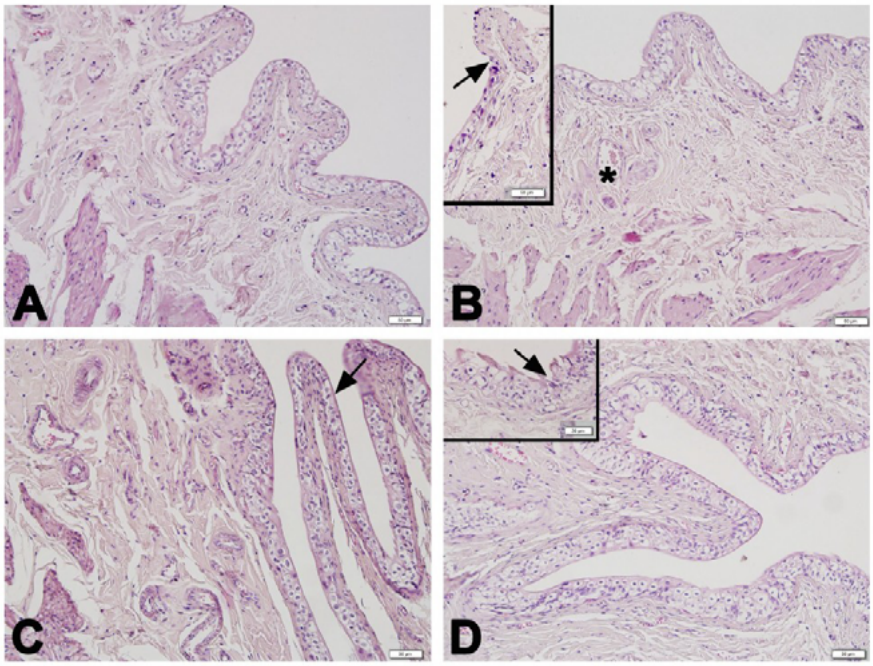


Figure 2: Bladder



PP-24 - Main Topics in Microscopy Techniques - Transmission Electron Microscopy (TEM)

Impact of TEM observation of ultrastructural alterations in rare lung diseases

Oya Evirgen[1], İrem Saadet Odabaş[1], Deniz Doğan Mülazimoğlu[2], Demet Karnak[2], Oya Kayacan[2], Nazan Çobanoğlu[3]

[1]Department of Histology and Embryology, Ankara University School of Medicine, Ankara, Turkiye

[2]Department of Chest Diseases, Ankara University School of Medicine, Ankara, Turkiye

[3]Department of Pediatric Pulmonology, Ankara University School of Medicine, Ankara, Türkiye

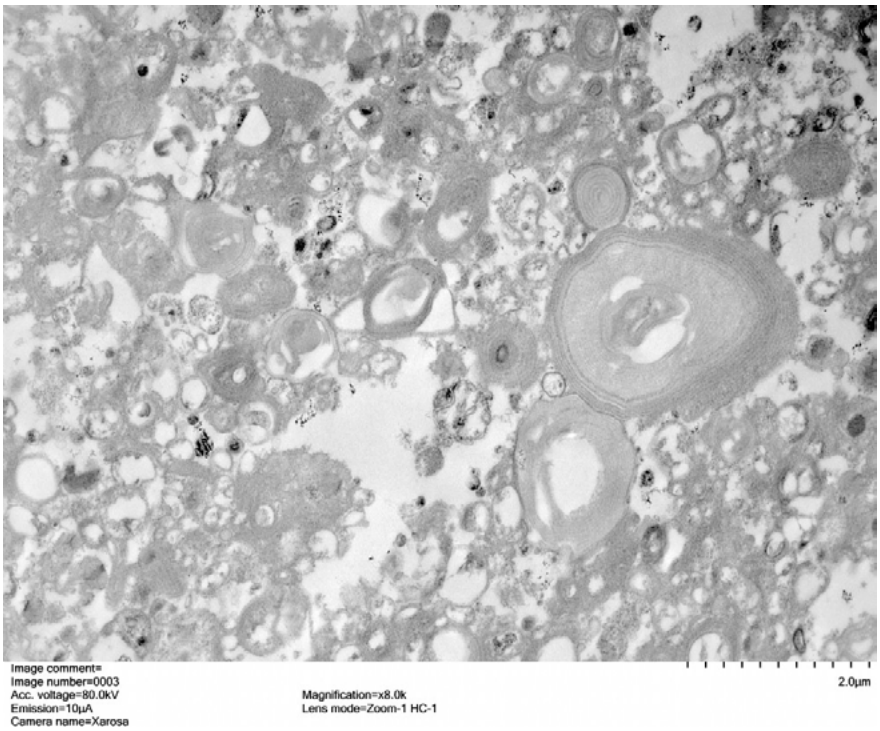
INTRODUCTION-AIM: A rare disease is defined as any disease that affects a small percentage (3.5-5.9%) of the population. Primary Ciliary Dyskinesia (PCD) is a genetically heterogenous group of recessive disorders with ultrastructural defects of axonem affecting ciliary movement resulting in chronic respiratory tract disease, fertility problems and organ laterality defects. Pulmonary Alveolar Proteinosis (PAP) is characterised by progressive diffuse intra-alveolar accumulation of surfactant and macrophages filling alveolar spaces causing cough, dyspnea, hypoxia, respiratory insufficiency or failure. The aim of this study is to provide an overview of the importance of electron microscopic findings on the diagnosis of these both rare lung diseases.

MATERIALS-METHODS: Lung bronchial brush biopsies and BAL (bronchoalveolar lavage) fluid were taken. The samples in glutaraldehyde solution were centrifuged for 10 min at 1500 Rpm. After discarding the supernatant, the pellets were fixed with fresh 2.5% glutaraldehyde post-fixed in 1% osmium tetroxide and processed and embedded in araldite. The semi-thin sections stained with toluidine blue examined under light microscopy (Leica DM 500) connected to a digital camera (Leica ICC50 hD). The ultra-thin sections were observed under TEM (HITACHI HT 7800, Germany)

RESULTS-CONCLUSION: In PCD, we observed outer and inner dynein arm defects and microtubular disorganization (Class I defects) and central complex defects (Class II defects) in transverse sections of axonemes. Non-specific abnormalities like compound cilia, disorganized axonemes, ciliary disorientation were also seen. In PAP, tubular myelin, lamellar bodies within the amorphous extracellular material with vacuolized, foamy macrophages were evident. For the diagnosis, algorithm begins with the clinical symptoms and continues with the performed tests (radiology, lung function tests, nitric oxide measurement, video analysis of ciliary function, immunofluorescence analysis of ciliary proteins and genetic testing). But the specific ultrastructural alterations observed by electron microscopy in PCD and PAP is still valuable and important for conforming the diagnosis.

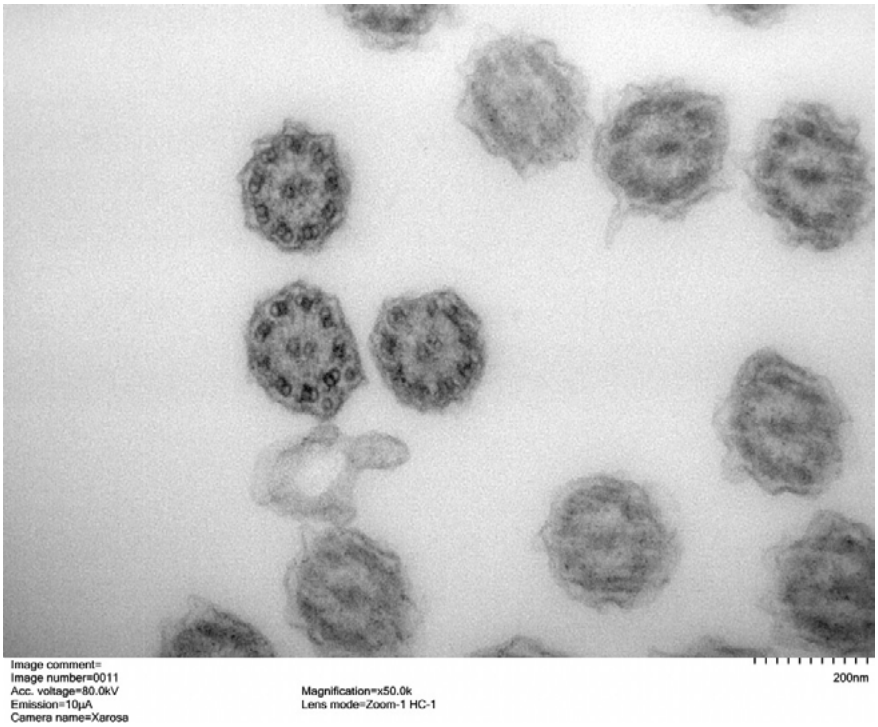
Keywords: lung, tem, ultrastructure

Figure 1



Ultra-thin section of BAL fluid sample showed abundant extracellular myelin-like multilamellated structures. x8.000 magnification.

Figure 2



Ultra-thin section of brush biopsy Class I defects showing disorganized axonem and loss of inner and outer dynein arms. x50.000 magnification.

PP-25 - Main Topics in Biological Sciences - Cancer Biology

Investigation of the cytotoxic effects of narciclasine in SH-SY5Y neuroblastoma cells

Ceren Oy, Seda Işıklar, Sema Serter Koçoğlu

Department of Histology and Embryology, School of Medicine, Bursa Uludag University, Bursa, Turkiye.

AIM: Neuroblastoma is the most common extracranial childhood tumor. High-risk neuroblastoma patients have an overall survival rate of less than 50% and a poor prognosis. There is a need to understand tumor biology and develop new, more effective therapies for patients with neuroblastoma. Narciclasine is a natural compound with anticancer and anti-inflammatory effects found in daffodils and other flowering plants of the Amaryllidaceae family. There is no study in the literature reporting the anticancer activity of narciclasine in neuroblastoma cells. The aim of this study was to evaluate the cytotoxic effects of narciclasine in SH-SY5Y neuroblastoma cells and compare them with HUVEC cells.

MATERIALS-METHODS: CCK-8 kit, a calorimetric method, was used to determine the effects of narciclasine on cell viability. SH-SY5Y and HUVEC cells were seeded in 96-well plates at a density of 1 × 104 cells/well in a volume of 100 µL per well in 3 replicates. 12.5nM, 25nM, 50nM, 100nM, 200nM, 400nM, 800nM, 1.6µM, 3.2µM narciclasine was added in dose groups and cells were incubated for 24, 48 and 72 hours. At the end of each incubation period, 10 µl of CCK8 solution was added and read at 450 nm in a microplate reader.

RESULTS: Narciclasine decreased SH-SY5Y cell viability in a dose- and time-dependent manner and did not cause any significant change in HUVEC cells. At 24 hours, 12.5, 25, 50 and 100nM of narciclasine decreased SH-SY5Y cell viability to 88, 77, 64 and 62%, respectively ($p<0.0001$). At 48 hours, between 12.5nM and 3.2µM concentration range, narciclasine decreased cell viability between 19% and 47%. 50nM narciclasine decreased cell viability to 59% ($p<0.0001$) and 100nM narciclasine to 53% ($p<0.0001$).

CONCLUSION: Our study demonstrated the cytotoxic effect of narciclasine on neuroblastoma cells. Our findings suggest that narciclasine may be a potential new chemotherapeutic agent on neuroblastoma cells.

Keywords: Neuroblastoma, narciclasine, cytotoxicity

PP-26 - Main Topics in Biological Sciences - Neurobiology

Effects of Postnatal Social Isolation on Neuroimmune Response in the BALB/c Mouse Model

Reyhan Özçelik[1], Kubilay Göçücü[2], Sinem Fırat[2], Gürcan Ertop[3], Şirin Funda Eren[2]

[1]Department of Pharmacy Services, Vocational School of Health Services, Istanbul Kent University, Istanbul, Turkey

[2]Department of Pathology Laboratory Techniques, Vocational School of Health Services, Istanbul Kent University, Istanbul, Turkey

[3]Department of Pathology Laboratory Techniques, Vocational School of Health Services, Acibadem M.A.A. University, Istanbul, Turkey

OBJECTIVE: This study investigates the potential neuroinflammatory effects of social play deprivation during early developmental stages in male mice. It aims to evaluate the impact of social isolation duration, re-socialization, and object-based environmental enrichment on neuroinflammation.

METHODS: In the experimental model, male BALB/c mice were subjected to short-term (4 weeks) and long-term (8 weeks) social isolation starting on postnatal day 23 following maternal separation. While some groups were isolated individually, other isolation groups were exposed to toy-enriched environments to provide environmental enrichment. Additionally, subsets of mice previously subjected to varying durations of isolation were re-socialized following the isolation period. At the end of the experiment, neuroinflammatory responses in brain regions, particularly the prefrontal cortex, amygdala, and hypothalamus, were assessed using immunohistochemical techniques. The markers used included IBA-1 (microglial activation), GFAP (astrocyte activation), and synaptophysin (a marker of synaptic density). Semi-quantitative evaluation of immunolabeling was performed using the H-score method. Neuronal morphology was further analyzed using Nissl staining.

RESULTS: Significant increases in microglial and astrocytic activation levels were observed in socially isolated groups, particularly those subjected to long-term isolation, accompanied by a reduction in synaptic density. In contrast, groups housed in enriched environments with toys and those undergoing re-socialization exhibited varying degrees of reduction in neuroinflammatory marker expression.

CONCLUSION: The findings suggest that early-life social interaction and environmental engagement exert protective effects on brain health. A lack of such stimulation may trigger neuroinflammatory processes that potentially elevate the risk of neurodegenerative disorders later in life.

Keywords: GFAP, IBA-1, Microglial activation, Neuroinflammation, Social isolation

PP-28 - Main Topics in Biological Sciences - Pathology

Ultrastructural Features of The Adenohypophysis During Acute Hypoxia

Samira Yaqubova, Tarana Sultanova, Elchin Akbarov, Akif Alakbarov, Mushfig Orujov, Arzu Ibishova, Gunash Aliyeva

Azerbaijan Medical University, Department of Pathological Anatomy, Baku, Azerbaijan

INTRODUCTİON: Hypoxia is widely used to enhance adaptive capacity, normalize psychophysiological status, and improve respiratory, cardiovascular, and endocrine functions, as well as to treat various diseases. Endocrine organs, especially the pituitary gland, play a crucial role in compensatory-adaptive responses to environmental stressors like hypoxia. Therefore, studying the immunological properties of the pituitary, the central organ of the hypothalamic-pituitary neuroendocrine system (HPNS), is essential in modern medicine.

AIM: The aim of this study was to investigate the characteristic ultrastructural changes and the main mechanisms of compensatory-adaptive processes occurring in the adenohypophysis cells under hypobaric hypoxia.

MATERİALS AND METHODS: The study used adult male white rats weighing 180–200 grams, raised under controlled conditions. The animals were divided into two groups: control and hypoxia. The control group received no treatment, while the hypoxia group was exposed to simulated atmospheric pressure equivalent to 2,000–3,000 meters altitude in a specialized barochamber. Adenohypophysis samples were collected on days 2 and 5 for electron microscopy and morphometric analysis.

RESULTS: Under hypoxic conditions, adenocytes of the adenohypophysis showed acute pathomorphological changes based on hypoxia's severity and duration. Electron microscopy revealed widespread cell destruction, vacuolization, and increased cell size. Mitochondrial cristae were swollen and damaged, and the endoplasmic reticulum cisternae were markedly dilated. In hypoxia-exposed animals, these morphofunctional changes indicated glandular adaptation and activation of compensatory processes. Such responses represent a general tissue reaction to hypoxia, reflecting the adenohypophysis's attempt to maintain function under reduced oxygen availability.

CONCLUSİON: It should be emphasized that hypobaric hypoxia exerts a dual effect on the adenohypophysis, causing both damaging and adaptive responses.

Keywords: Hypoxia, Ultrastructure, Adenohypophysıs

PP-30 - Main Topics in Biological Sciences - Botanical Microscopy

Scanning Electron Microscopy Reveals Microstructural Leaf Damage from Spider Mite Infestation in *Nerium oleander*

Pınar Akkuş Süt, Gülnihal Bozdağ, Rümeysa Nur Afşar, Fikrettin Şahin

Yeditepe University, Department of Genetics and Bioengineering, Istanbul, Türkiye

AIM: *Nerium oleander*, a Mediterranean ornamental species, displays leaf morphological alterations in response to environmental changes and pathogenic infections, including spider mite infestation, which often leads to characteristic foliage damage. The micromorphological structures on the leaf surface—such as stomata, trichomes, and the arrangement of epidermal cells—are important indicators of the plant's health [1]. In this study, the surface micromorphology of *Nerium oleander* leaves was examined using scanning electron microscopy (SEM), and the effects of disease symptoms, particularly those associated with spider mite damage, on microscopic structures were investigated.

MATERIALS-METHODS: In this study, leaf samples were collected from both healthy *Nerium oleander* plants and those showing disease symptoms in natural conditions. The samples were sectioned and sputter-coated with gold/palladium for imaging with a scanning electron microscope (Zeiss EVO 40). The upper (adaxial) and lower (abaxial) leaf surfaces were evaluated separately. Stomatal density and shape, epidermal cell arrangement, and the presence of trichomes were comparatively analyzed.

RESULTS: SEM analysis revealed that healthy leaves exhibited organized epidermal cells, symmetrical stomata, intact waxy layers, and normal trichome density, while diseased leaves showed disrupted stomatal crypt surfaces, reduced wax layers, weakened cell junctions, and significantly decreased stomatal density.

CONCLUSION: This study revealed that the morphological structure of *Nerium oleander* leaves, provides important insights into plant health. Microscopic changes occurring in dysmorphic leaves, including those resulting from spider mite infection and related foliage damage, were identified through SEM imaging. The study confirms SEM's utility in visualizing disease-induced leaf changes, highlighting its role in early plant pathology diagnostics.

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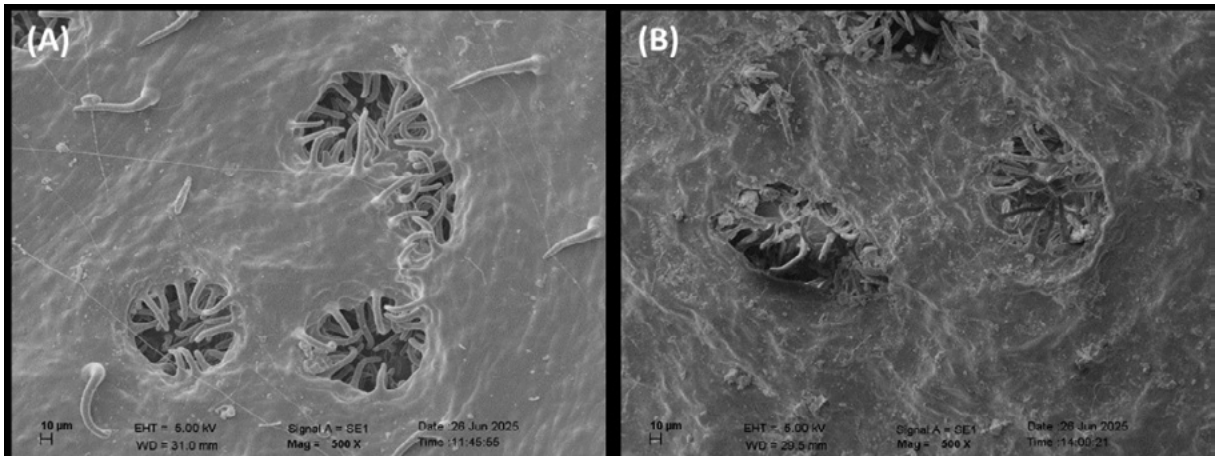
Keywords: Leaf micromorphology, {Nerium oleander}, Scanning electron microscopy, Stomatal crypts,

Figure 1. SEM micrographs of stomatal crypts of Nerium oleander. (A) Healthy plant leaf. (B) Dysmorphic plant leaf.



PP-31 - Main Topics in Biological Sciences - Structures and Functions of Cells and Organelles

Urtica dioica treatment improves autophagy and cognitive function in a rat model of streptozotocin-induced neurodegeneration

Sule Ayla[1], Halil Saygı[1], Merve Sahin[1], Ebru Ciftkaya[2], Aysu Kilic[3], Sadrettin Pence[4], Fatemeh Bahadori[5], Elif Gelenli Dolanbay[1], Birsen Elibol[6]

[1]Department of Histology and Embryology, School of Medicine, Istanbul Medeniyet University, Istanbul, Turkey

[2]Department of Internal Medicine, Marmara University Pendik Training and Research Hospital, Istanbul, Turkey

[3]Department of Physiology, School of Medicine, Bezmialem Vakif University, Istanbul, Turkey

[4]Department of Physiology, School of Medicine, Istanbul Medeniyet University, Istanbul, Turkey

[5]Department of Basic Pharmaceutical Sciences, School of Pharmacy, Istanbul University-Cerrahpasa, Istanbul, Turkey

[6]Department of Medical Biology, School of Medicine, Istanbul Medeniyet University, Istanbul, Turkey

INTRODUCTION: Alzheimer's disease (AD) is a neurodegenerative disorder characterized by protein accumulation and impaired autophagy. Urtica dioica (UD) is a plant with antioxidant and anti-inflammatory properties that may have neuroprotective effects.

AIM: This study aimed to investigate the effects of UD treatment on autophagy-related proteins and cognitive function in a rat model of streptozotocin (STZ)-induced neurodegeneration.

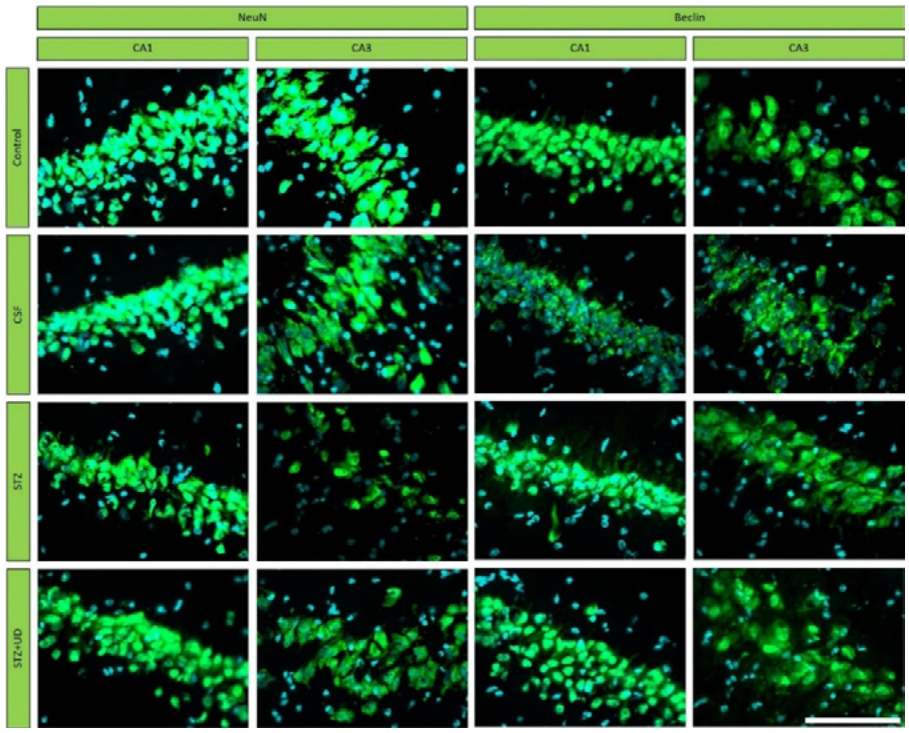
MATERIALS-METHODS: Twenty-two adult female Long-Evans rats were divided into four groups: control (n=5), sham (n=6), STZ (n=6), and STZ+UD (n=5). STZ (3 mg/kg) was administered intracerebroventricularly (i.c.v.). The STZ+UD group received UD at 50 mg/kg/day for four weeks. Cognitive function was assessed using the passive avoidance task. Western blotting and immunofluorescence were performed for molecular analyses. Data were analyzed by ANOVA with Fisher's LSD post-hoc test ($p \leq 0.05$).

RESULTS: The STZ group showed impaired memory performance in the passive avoidance task ($p = 0.042$), while UD treatment alleviated this deficit. STZ significantly reduced Beclin ($p = 0.0021$), ATG5 ($p = 0.0078$), and LC3β ($p = 0.0003$) expression levels. UD significantly increased Beclin ($p = 0.0421$) and LC3β ($p = 0.0038$) levels compared to the STZ group. The STZ group had a reduced number of NeuN-positive cells in the hippocampus; this was significantly improved with UD treatment ($p < 0.05$).

CONCLUSION: UD treatment improved cognitive function and restored autophagy-related protein levels in rats with STZ-induced neurodegeneration. These findings suggest that UD could be a promising candidate for the treatment of AD-like neurodegenerative conditions through modulation of autophagy.

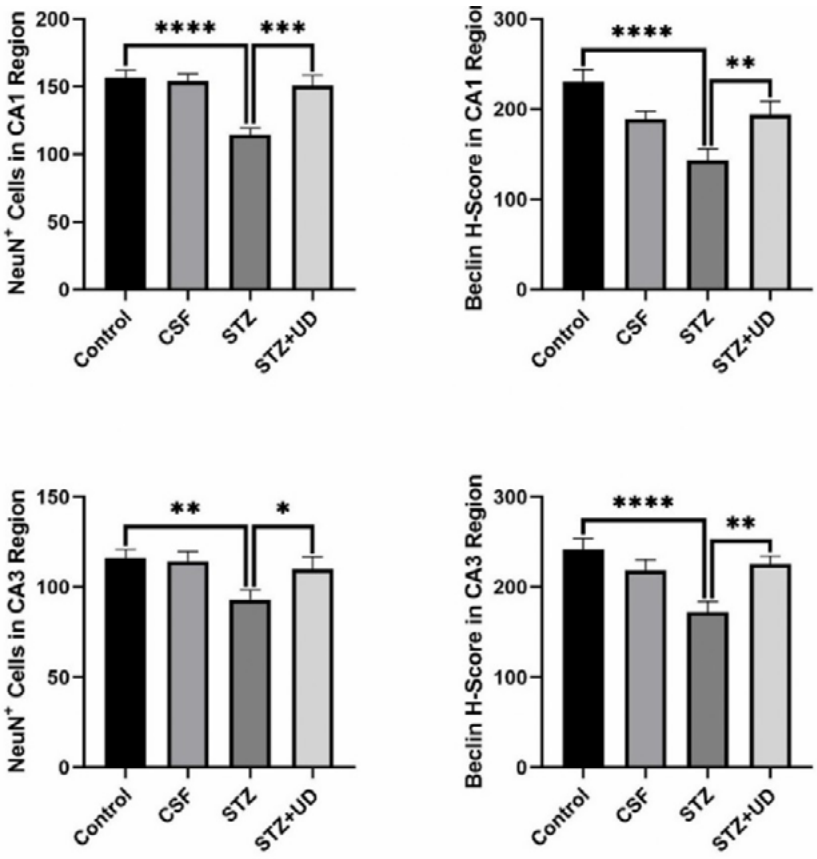
Keywords: Alzheimer's disease, Autophagy, Rat, Streptozotocin, Urtica dioica

Figure 1



Immunoflourescence images from hippocampal CA1-CA3 subregions stained with NeuN and Beclin antibodies. (Scale Bar: 100 µm.)

Figure 2



*Quantitative analysis of neuronal survival and autophagy marker expression in hippocampal subregions. (A) Number of NeuN⁺ cells in the CA1 region. (B) Beclin H-score in the CA1 region. (C) Number of NeuN⁺ cells in the CA3 region. (D) Beclin H-score in the CA3 region. Data are expressed as mean ± SEM. Statistical significance: *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001, ****p ≤ 0.0001.*

PP-34 - Main Topics in Biological Sciences - Biomaterials and Tissue Engineering

Effect of dexamethasone/hydrocortisone on endothelial barrier integrity in a 3D *in vitro* vascular model study

Beyza Yüz[1], Gözde Ervin Köle[2], Zeynep Tokcaer Keskin[1], Deniz Yucel[3], Deniz Yucel[4], Gözde Ervin Köle[4]

[1]Department of Molecular Biology and Genetics, Faculty of Engineering and Natural Sciences, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[2]Graduate School of Health Sciences, Department of Medical Biotechnology, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[3]Department of Histology and Embryology, School of Medicine, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

[4]Biomaterials Application and Research Center, Acıbadem Mehmet Ali Aydınlar University, Istanbul, Turkiye

AIM: Cardiovascular diseases (CVDs), the leading cause of death worldwide, are often associated with chronic inflammation and endothelial barrier dysfunction. While individual glucocorticoids have shown therapeutic potential in CVD, their combined effects remain unclear. This study aims to investigate the combined effect of dexamethasone and hydrocortisone on endothelial barrier function within a 3D in vitro vascular model.

MATERIALS-METHODS: A simulation of the in vitro vascular model was performed with a computational fluid dynamics (CFD)-based flow analysis to mimic vascular conditions. A polymeric tubular scaffold was produced by dip-coating using polycaprolactone-poly(lactic-co-glycolic acid), and its morphology was examined with SEM. Human umbilical vein endothelial cells (HUVECs) were seeded onto the luminal side of the scaffold and cultured in the presence of dexamethasone and hydrocortisone. On day 21, intercellular adhesion/junction proteins were investigated with immunocytochemistry, and barrier integrity was assessed via permeability analysis.

RESULTS: CFD simulation revealed a parabolic velocity profile, with maximum centerline velocities reaching approximately 1.45 m/s, and wall shear stress values ranging from 0.5 Pa to 2 Pa. SEM results showed that the tubular scaffold was obtained with a diameter of 2.9 mm and a 99 µm wall thickness. HUVECs, expressing adhesion/junction protein, PECAM1 (CD31), were attached and spread on the luminal surface of the tubular scaffold. On day 21, permeability studies at 120 min showed that the combination treatment resulted in the lowest permeability ($P = 2.34 \times 10^{-6}$ cm/s), while all treatments reduced permeability compared to the control.

CONCLUSION: The preliminary results indicate that the designed 3D in vitro vascular model with its endothelial barrier integrity could be a promising tool for understanding the mechanism of CVDs and exploring treatment approaches involving glucocorticoid combinations.

This study is supported by the Health Institutes of Türkiye (TÜSEB) under the 2025-A1-01 program (Project No. 43903).

Keywords: Endothelial Barrier, Tubular Scaffold, Glucocorticoids

PP-35 - Main Topics in Biological Sciences - Organoids

Imaging Whole-Mount Airway Organoids for a 'Lung in a Dish' Model: A Multi-Approach Using Brightfield, Confocal, and Electron Microscopy

Ozgecan Kayalar[1], Gamze Demirel[2], Olgu Enis Tok[4], Nur Konyalilar[5], Hasan Bayram[6], Ranan Gulhan Aktas[3]

[1]Çukurova University, Department of Biology, Divison of Molecular Biology, Sarıcam, Adana, Turkey

[2]Cancer and Stem Cell Research Center, School of Medicine, Maltepe University, Istanbul, Turkey

[3]Cellorama, Mansfield, MA, USA

[4]Department of Histology and Embryology, Research Institute for Health Sciences and Technologies, Istanbul Medipol University, Istanbul, Turkey

[5]Research Center for Translational Medicine, Koc University, Istanbul, Turkey

[6]Department of Pulmonary Medicine, School of Medicine, Koc University, Istanbul, Turkey

Organoids are rapidly gaining prominence as in vitro models for disease modeling and drug discovery, a trend amplified by recent FDA/NIH initiatives promoting alternatives to animal testing. In this study, we investigate the spatial visualization of airway organoids at various developmental stages using brightfield, confocal, and electron microscopy.

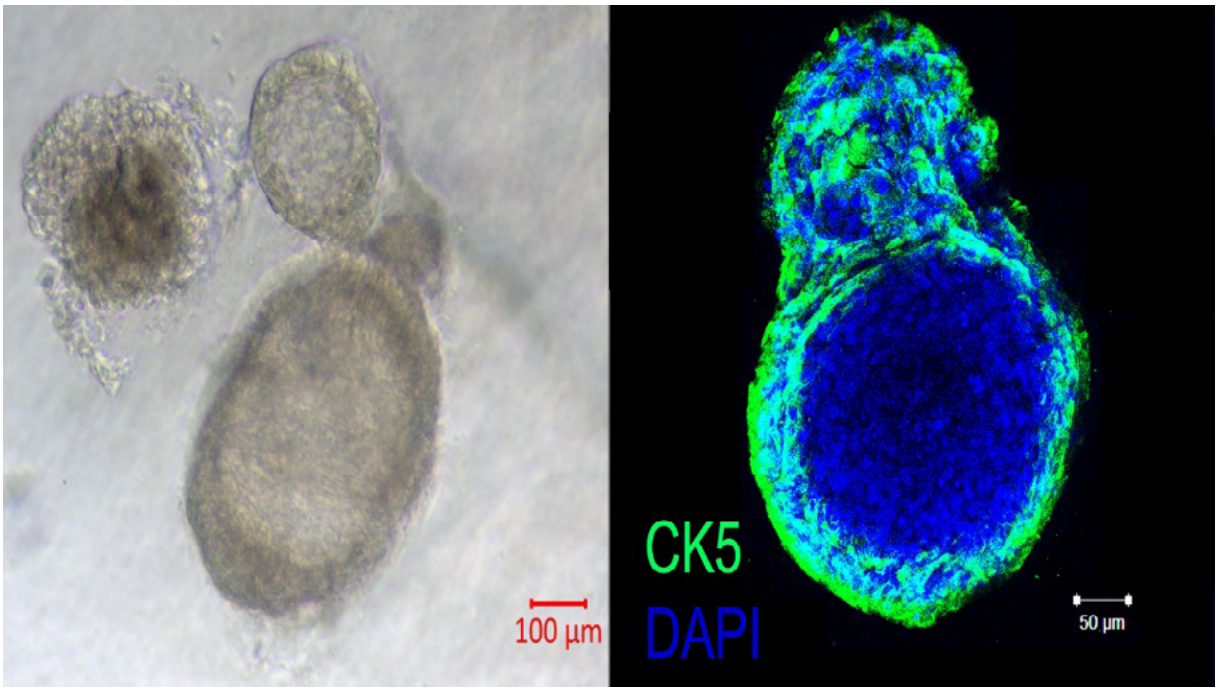
Our goal was to examine the entire 3D growing organoids while they are still in the hydrogel, thereby obtaining more accurate results without distorting their 3D architecture. Airway organoid models derived from human induced pluripotent stem cells were grown in CellO-Ms. The organoids at various developmental stages were compared using an inverted phase-contrast microscope, a confocal microscope, and a transmission electron microscope. Axiovert Inverted Phase Contrast Microscope has been used to visualize morphological changes based on epithelial formation, budding, and compartmentalization in different sizes of organoids. The LSM700 Laser Scanning Microscope was used to visualize CK5+ basal stem cells in developing organoids. Examination of the ultrastructural features of the epithelial cells surrounding organoids was made using a Zeiss TEM.

Results show that as organoids grow, cell clumps develop into spherical structures surrounded by epithelial cells, and the epithelial tissue begins to proliferate and differentiate. In the meantime, budding and compartmentalization start. During these differentiations, CK5 (+) stem cells mainly locate at these active sites, such as budding and compartmentalization areas. Transmission electron microscopy reveals the formation of basal epithelial cells, which actively secrete, as well as the development of microvilli and cilia on the apical sites of the cells, and the formation of a basement membrane.

The study demonstrates fine structural features of differentiating cells surrounding the airway organoids, provides information on CK(+) stem cells at the active sites in those differentiating organoids, and creates a powerful "lung in a dish" model to study respiratory system development.

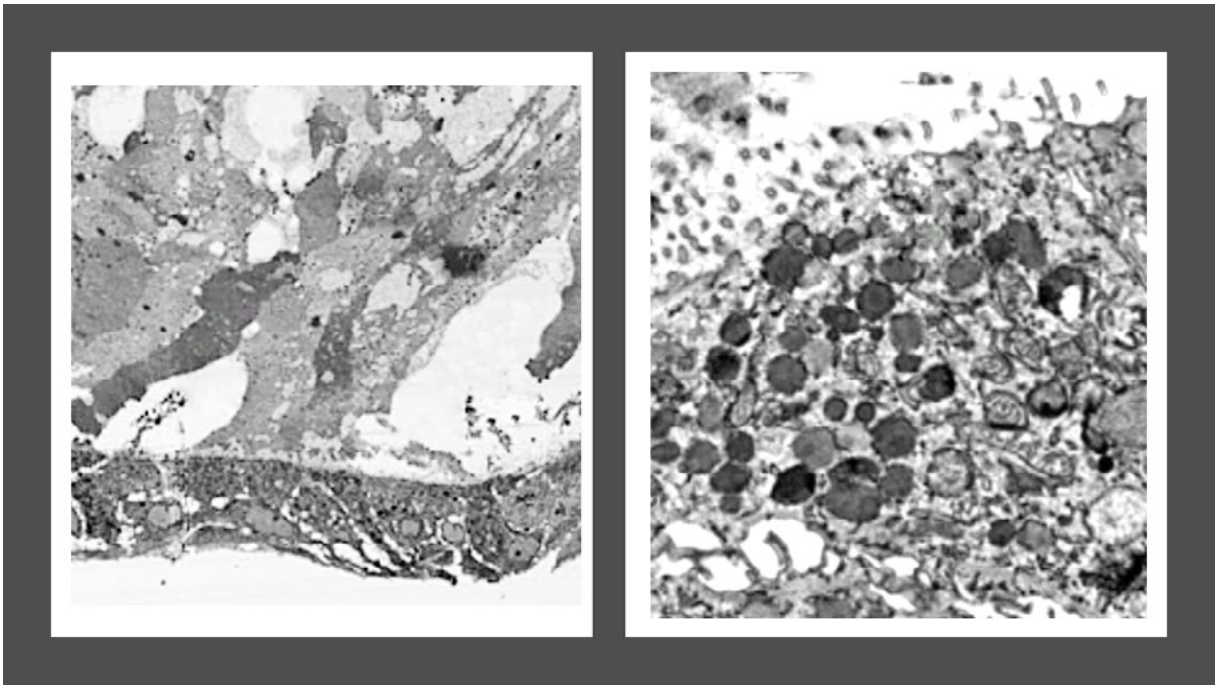
Keywords: Organoids, Microscopy, Lung, Stem Cells, 3D Cell Culture

Figure 1: Phase Contrast and Confocal Microscopic Images of Airway Organoids



Three distinct images capture airway organoids at different points in their development, illustrating the progression of their growth and structural changes. The second image highlights a single organoid, specifically showing CK(+) stem cells surrounding the organoid and at the location of budding.

Figure 2: Electron Microscopic Images of Airway Organoids



The first image shows the initial epithelial formation of an airway organoid, which is a key step in its development. The second image provides a more detailed view, demonstrating the advanced differentiation of these cells with the presence of microvilli, secretory vesicles, and highly developed cytoplasmic organelles on their apical surfaces. This highlights the progression of the organoid from a simple structure to a more complex, functional tissue.

PP-36 - Main Topics in Biological Sciences - Immunohistochemistry and Cytochemistry

Effects of cemtirestat, epalrestat and stobadin on metabolic perturbations induced by fructose alone or combined with streptozotocin in aged rats

Fatma Kaya Dağıstanlı[1], Aslı Ceylan[2], Zübeyir Elmazoğlu[3], Nigar Efendiyeva[4], Sanem Gulistan Saribas[5], Belisa Kaleci Pilafi[6], Milan Stefek[7], Nuriye Nuray Ulusu[8], Çimen Karasu[9]

[1]Department of Medical Biology, Cerrahpasa Medical Faculty, Istanbul University-Cerrahpasa, Istanbul, Turkey.

[2]Department of Medical Pharmacology, Faculty of Medicine, Yıldırım Beyazıt University, Bilkent, 06800, Ankara, Turkey.

[3]Department of Pharmacology, Faculty of Pharmacy, Ankara Medipol University, Ankara, Turkey.

[4]Department of Medical Biochemistry, Faculty of Medicine, Gazi University, Ankara, Turkey.

[5]Department of Histology and Embryology, Faculty of Medicine, Kirşehir Ahi Evran University, Kırşehir, Turkey.

[6]Medical University of Tirana, University Dental Clinic. Tirana, Albania.

[7]Institute of Experimental Pharmacology and Toxicology, CEM, Slovak Academy of Sciences, Bratislava, Slovak Republic.

[8]Department of Biochemistry, School of Medicine, Koç University, Istanbul, Turkey.

[9]Department of Medical Pharmacology, Cellular Stress Response and Signal Transduction Research Laboratory, Faculty of Medicine, Gazi University, Ankara, Turkey.

AIM: Aldose reductase (AR), the first enzyme of the polyol pathway, contributes to oxidative and carbonyl stress in diabetes, making AR inhibitors (ARIs) therapeutically valuable[1-3]. This study investigated the effects of cemtirestat (CMTI), a compound with both ARI and antioxidant properties, compared to epalrestat (EPA, an ARI) and stobadin (STB, an antioxidant), in an in vivo model of glucolipotoxicity induced by fructose(CF) or fructose plus streptozotocin(DF).

MATERIALS-METHODS: The type 2 diabetes model was established using fructose combined with a low dose of STZ, as previously reported. Aged rats were untreated (C) or treated with two different doses of CMTI (2.5-7.5 mg/kg/bw), EPA (25-50 mg/kg/bw) or STB (25-50 mg/kg/bw) for 14-week.Liver tissues were collected for histological evaluation using PAS and Masson's Trichrome staining (to assess glycogen storage and fibrosis). Immunohistochemistry was performed to examine insulin, glucagon, and somatostatin expression in pancreas tissue sections. Apoptosis was assessed via TUNEL and active caspase-3 staining. All data underwent statistical analysis.

RESULTS: ARIs and STB did not affect hyperglycemia in CF and DF rats but lowered elevated cholesterol in DF. CMTI increased triglycerides in DF, while EPA and STB reduced them. ARIs inhibited AST in CF and DF. ALT, ALP, and GGT were elevated in DF; CMTI and STB further increased ALT but reduced ALP and GGT at low doses. ARIs and STB improved the GSH/GSSG ratio, and reduced carbonyls, MDA, and catalase, though high doses increased GST. CMTI partially improved hepatocyte integrity and glycogen storage, unlike EPA and STB. However, CMTI did not reduce immunopositive cell counts for TUNEL and caspase-3 in liver and pancreas of DF and had no plausible effects on cells that secrete insulin, glucagon, and somatostatin.

CONCLUSION: The findings may offer valuable insights that could facilitate the development of novel ARI/AO compounds and CMTI derivatives.

1-Kaya,et al,Drug Chem Toxicol.2024;47:710-720.

Keywords: Diabetes, Liver, Pancreas, Chemtiestat, Epalrestat, Stobadin

PP-39 - Main Topics in Biological Sciences - Tissues and Systems

Ameliorative effects of intermittent fasting and fucoidan on erectile tissue in STZ/NA-induced diabetic rats

Öykü Ileri Meşe[1], Hatice Maraş[1], Zarife Nigar Özdemir Kumral[2], Meral Yüksel[3], Özlem Tuğçe Çilingir Kaya[1]

[1]Marmara University, Faculty of Medicine, Department of Histology and Embryology

[2]Marmara University, Faculty of Medicine, Department of Physiology

[3]Marmara University, Vocational School of Health Services, Medical Laboratory Techniques Program

INTRODUCTION: Type 2 diabetes (T2D) impairs erectile function through oxidative stress and endothelial dysfunction, disrupting corpus cavernosum architecture. Intermittent fasting (IF) and fucoidan possess potent antioxidant and anti-inflammatory effects. This study evaluates, for the first time, their combined protective potential in diabetic erectile dysfunction (ED).

AIM: The aim is to investigate the therapeutic effects of fucoidan and IF on corpus cavernosum function and morphology in T2D-induced ED.

MATERIAL-METHODS: Male Sprague-Dawley rats (n=40) were assigned to Control, Diabetes, Diabetes+Fucoidan (50 mg/kg, i.p.), Diabetes+IF, and Diabetes+Fucoidan+IF groups. T2D was induced with streptozotocin (65 mg/kg) and nicotinamide (110 mg/kg). Treatments lasted four weeks. Organ bath functional tests (phenylephrine-induced contraction, carbachol-induced relaxation) to both confirm the ED model and evaluate the effects of IF and fucoidan, oxidative stress (SOD activity, luminol/lucigenin chemiluminescence), and histological examinations (H&E, Masson's trichrome) were performed. Data were analyzed using one-way ANOVA with Tukey's post-hoc test.

RESULTS: Diabetes caused trabecular disorganization, sinusoidal narrowing, fibrosis, decreased SOD activity, and increased ROS. All treatments improved histology and oxidative parameters, with the combination group showing the closest resemblance to control and the most consistent biochemical recovery. Luminol-based ROS decreased significantly with IF and combination therapy, while lucigenin-based superoxide reduction was significant only in the combination group. Functional deficits in contractility and relaxation were partially restored in single-treatment groups, but the combination yielded the highest recovery in both parameters.

CONCLUSION: Fucoidan and IF individually attenuate diabetes-induced morphological, oxidative, and functional impairments in erectile tissue. Their combination offers improved protection, suggesting potential as a therapeutic strategy for diabetes-associated ED.

Keywords: Type II Diabetes, Corpus Cavernosum, Erectile Dysfunction, Fucoidan, Intermittent Fasting

PP-45 - Main Topics in Biological Sciences - Stem Cell Biology

Investigating cellular survival in ALS patient-specific cardiomyocytes derived from induced pluripotent stem cells

Hazal Uraz, Gizem Yörükoğlu, Aylin Nebol, Esra Çağavi

Medical Biology and Genetics Graduate Program, Institute of Health Sciences, Istanbul Medipol University, Istanbul, Türkiye

INTRODUCTION: Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease characterized primarily by motor neuron degeneration and loss. The *C9ORF72* mutation has the highest prevalence in familial ALS. Although clinical reports documented arrhythmias and other cardiovascular complications in ALS patients, cellular and molecular studies in the cardiovascular system are extremely limited. Recently, we characterized human cardiomyocytes (iCMs) derived from *C9ORF72* mutation-bearing ALS-patient-specific induced pluripotent stem cells (iPSCs), showing oxidative stress elevation, TDP43 protein mislocalization, and other ALS hallmark pathologies in cardiac cells for the first time in the literature. It is still unknown whether cardiomyocytes also display cell survival defects similar to the motor neuron loss in ALS pathogenesis.

AIM: Here, we aimed to investigate cell survival in *C9ORF72* mutation-carrying ALS patient-derived iCMs *in vitro* for the first time in the literature.

MATERIALS-METHODS: The iCMs were differentiated from healthy, ALS-patient, and CRISPR-Cas9 gene-corrected isogenic human iPSC lines and characterized at the molecular and functional levels by immunofluorescence (IF) and video-based contractility analysis. Next, cell viability was comparatively analyzed by Calcein-AM/PI staining, and cleaved caspase-3 (CC3) immunostaining in iCMs (n=3).

RESULTS: iCMs showed cardiac-specific cTnT protein expression by IF and spontaneous contractions.
The *C9ORF72* mutation-carrying iCMs showed significantly reduced cell viability compared to the isogenic control, as measured by the ratio of $Calcein^{+}/PI^{-}$ cells to the total cell count ($p < 0.05$). Furthermore, CC3 immunoreactivity in ALS patient-derived iCMs displayed a higher apoptotic index than the control groups.

CONCLUSIONS: Collectively, our findings revealed a reduction in cardiac cell viability *in vitro* at the ALS-associated human iCMs while showing an increase in the apoptotic index. We provided the first *in vitro* evidence for the possible contribution of the *C9ORF72* mutation in decreased cardiac cell survival, reminiscent of the motor neuron loss phenotype.

Keywords: Amyotrophic Lateral Sclerosis (ALS), C9ORF72 mutation, cell viability, induced pluripotent stem cells (iPSCs), cardiomyocytes (CMs).

PP-46 - Main Topics in Microscopy Techniques - Artificial Intelligence and Microscopy

Can artificial intelligence teach histology? A pilot study comparing multimodal large language models in organ identification and histological feature recognition

Sefa Burak Çam, Fatma Ayça Öyken

Hacettepe University, Faculty of Medicine, Dept. of Histology and Embryology, Ankara, Turkey

INTRODUCTION: Artificial intelligence is reshaping medical education, and multimodal large language models (MLLMs) offer strong potential by combining text and image analysis. Their integration makes them suitable for histology teaching, where reliable recognition of tissues and microscopic structures is vital. However, their effectiveness in medical histology education remains unclear.

Aim
This pilot study examines the accuracy of leading MLLMs in histological interpretation tasks within preclinical curricula.

METHODS: Sixty micrographs of healthy rat kidney, liver, thyroid, esophagus, and trachea (n=12 each) were selected from MMO-Net database (1). Regions of interest were captured using QuPath, and images were submitted to Gemini Pro 2.5, GPT-5, and Claude 4 Sonnet with standardized bilingual prompts: organ identification (prompt 1) and histological feature description (prompt 2). Responses were recorded and analyzed.

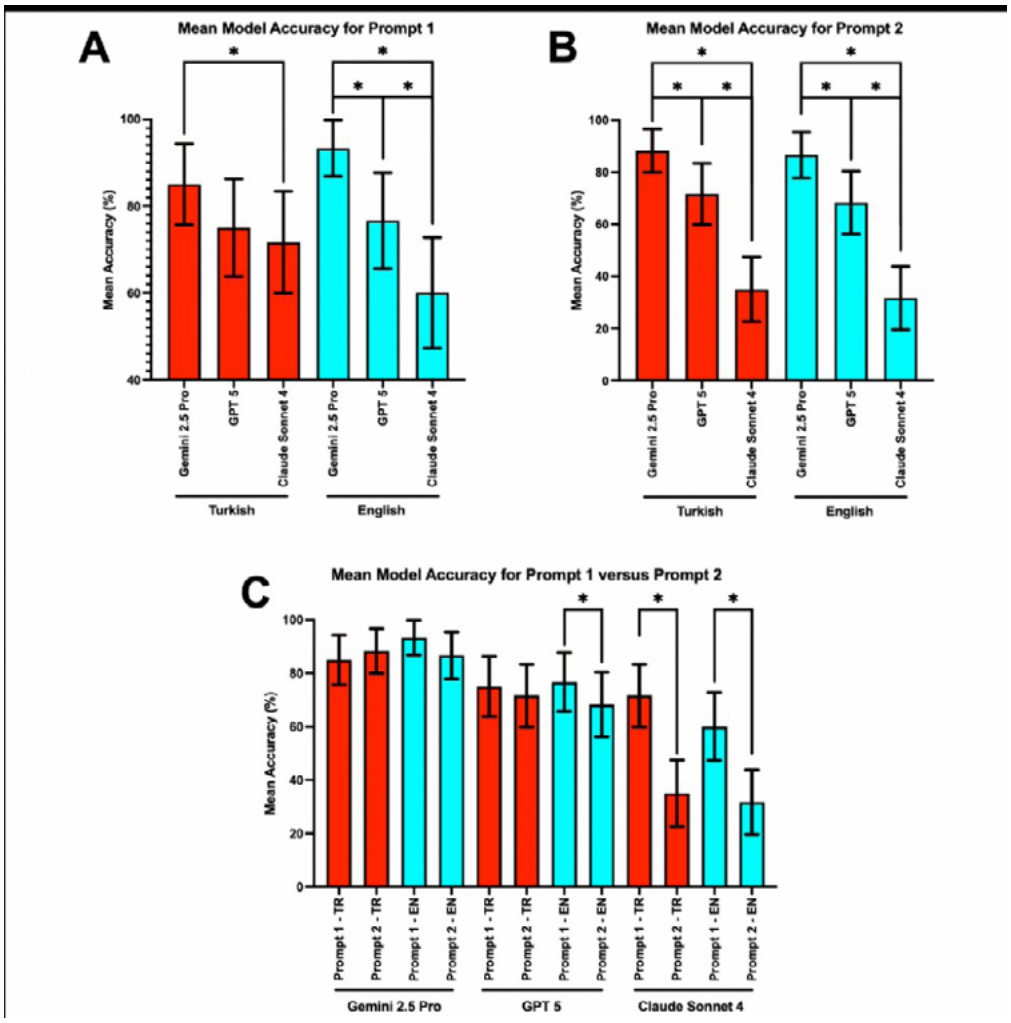
RESULTS: For organ identification, Gemini outperformed GPT and Claude in English ($p = 0.0133$ and $p < 0.0001$) and surpassed Claude in Turkish ($p = 0.0421$). For histological description, Gemini demonstrated superior accuracy in both English ($p = 0.02$ and $p < 0.0001$) and Turkish ($p = 0.0133$ and $p < 0.0001$). All models performed better on parenchymal versus luminal organs, which showed more variable success rates. Claude's performance declined significantly when moving from simple identification to the more complex description task in Turkish and English ($p < 0.0001$ and $p = 0.0004$). GPT showed a similar decline in English ($p = 0.0241$).

CONCLUSION: Medical students mainly need reliable tissue identification and feature recognition. Our findings reveal inconsistent MLLM performance, varying by organ type and task complexity, emphasizing the need for specialized, validated AI models in histology education.

References
Serna, C. G. et. al. 2022. MMO-Net (Multi-Magnification Organ Network): A use case for Organ Identification using Multiple Magnifications in Preclinical Pathology Studies. Journal of Pathology Informatics, 13, 100126.

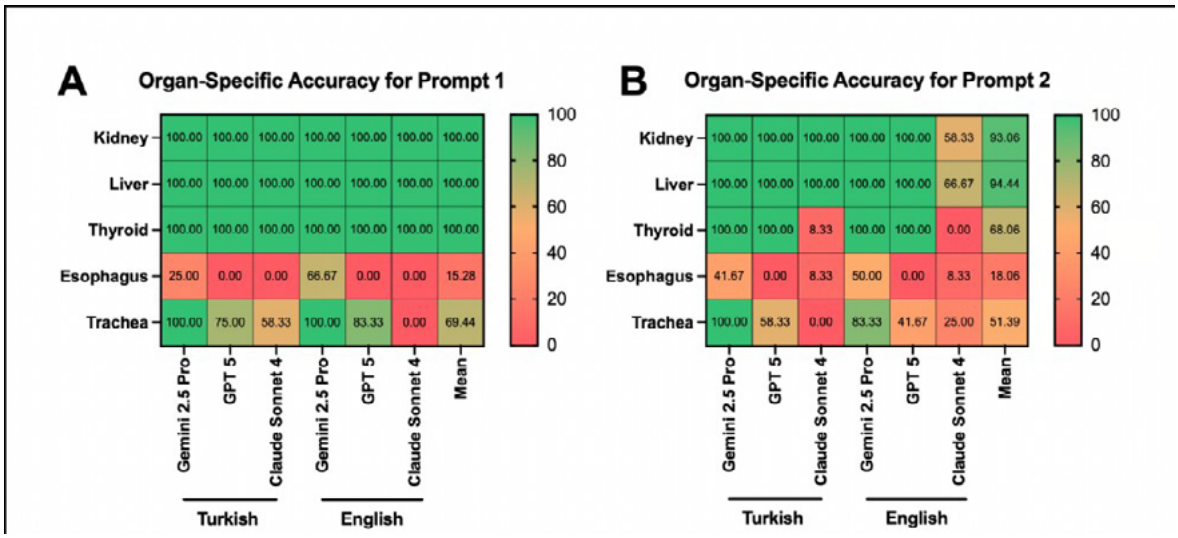
Keywords: Artificial intelligence, histology, large language models, medical education

Figure 1



Mean model accuracy for Prompt 1 (A), Prompt 2 (B), and comparison of model accuracy between Prompt 1 and Prompt 2 (n=60 for each model. An asterisk (*) indicates p<0.05).

Figure 2



Organ-Specific accuracy for Prompt 1 (A) and Prompt 2 (B) (n=12 for each organ).

PP-49 - Main Topics in Biological Sciences - Stem Cell Biology

Investigating cellular survival in ALS patient-specific cardiomyocytes derived from induced pluripotent stem cells

Hazal Uraz, Gizem Yörükoğlu, Aylin Nebol, Esra Çağavi

Medical Biology and Genetics Graduate Program, Institute of Health Sciences, Istanbul Medipol University, Istanbul, Türkiye

INTRODUCTION: Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease characterized primarily by motor neuron degeneration and loss. The *C9ORF72* mutation has the highest prevalence in familial ALS. Although clinical reports documented arrhythmias and other cardiovascular complications in ALS patients, cellular and molecular studies in the cardiovascular system are extremely limited. Recently, we characterized human cardiomyocytes (iCMs) derived from *C9ORF72* mutation-bearing ALS-patient-specific induced pluripotent stem cells (iPSCs), showing oxidative stress elevation, TDP43 protein mislocalization, and other ALS hallmark pathologies in cardiac cells for the first time in the literature. It is still unknown whether cardiomyocytes also display cell survival defects similar to the motor neuron loss in ALS pathogenesis.

AIM: Here, we aimed to investigate cell survival in *C9ORF72* mutation-carrying ALS patient-derived iCMs *in vitro* for the first time in the literature.

MATERIALS-METHODS: The iCMs were differentiated from healthy, ALS-patient, and CRISPR-Cas9 gene-corrected isogenic human iPSC lines and characterized at the molecular and functional levels by immunofluorescence (IF) and video-based contractility analysis. Next, cell viability was comparatively analyzed by Calcein-AM/PI staining, and cleaved caspase-3 (CC3) immunostaining in iCMs (n=3).

RESULTS: iCMs showed cardiac-specific cTnT protein expression by IF and spontaneous contractions.
The *C9ORF72* mutation-carrying iCMs showed significantly reduced cell viability compared to the isogenic control, as measured by the ratio of $Calcein^{+}/PI^{-}$ cells to the total cell count ($p < 0.05$). Furthermore, CC3 immunoreactivity in ALS patient-derived iCMs displayed a higher apoptotic index than the control groups.

CONCLUSIONS: Collectively, our findings revealed a reduction in cardiac cell viability *in vitro* at the ALS-associated human iCMs while showing an increase in the apoptotic index. We provided the first *in vitro* evidence for the possible contribution of the *C9ORF72* mutation in decreased cardiac cell survival, reminiscent of the motor neuron loss phenotype.

Keywords: Amyotrophic Lateral Sclerosis (ALS), C9ORF72 mutation, cell viability, induced pluripotent stem cells (iPSCs), cardiomyocytes (CMs).

PP-50 - Main Topics in Biological Sciences - Immunohistochemistry and Cytochemistry

Effects of Topiramate on Ovaries: A study in Obese and Non-Obese Rats

Alsharifashahed Hussein Hazem Al Abdali[1], Rüveyda Demirbozan[1], Amna Atiq[1], Roqaiyeh Hasani[1], Ayşe Sevde Yıldız[1], Seda Sezer[2], Ceren Erdem Altun[2], Işınsu Aydın Alkan[3], BERRİN ZUHAL[2]

[1]Medical Faculty Students, Faculty of Medicine, Okan University, Istanbul, Turkey

[2]Department of Histology and Embryology, Faculty of Medicine, Okan University, Istanbul, Turkey

[3]Department of Basic Medical Sciences, Faculty of Dentistry, Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey

AIM: Obesity is a growing global health concern, with rising prevalence due to lifestyle changes, unhealthy diets, and genetic predisposition. Pharmacological interventions are often preferred by patients seeking weight loss. Topiramate, an antiepileptic drug, has gained attention for its weight-reducing effects. This study aims to investigate the potential protective role of topiramate on ovarian tissues under obese conditions, particularly regarding inflammation, follicular health, and metabolic–hormonal regulation.

MATERIALS-METHODS: Twenty-four adult female Wistar Albino rats (9–10 weeks, 300–350 g) were randomly assigned to four groups: Non-obese control (NOC), Non-obese topiramate (NOT), Obese control (OC), and Obese topiramate (OT). Non-obese rats received standard chow, whereas obese groups were fed a 40% high-fat diet. From week nine, topiramate treatment was initiated in relevant groups. At week fifteen, rats were euthanized under anesthesia, and ovarian tissues were collected for histopathological and serological evaluation.

RESULTS: The OC group displayed pronounced ovarian damage, including reduced healthy follicles, increased atresia, stromal fibrosis, and elevated NF-κB expression. Conversely, topiramate treatment in the OT group significantly improved ovarian histology, showing enhanced follicle development, decreased collagen deposition, and reduced NF-κB expression. These findings suggest anti-inflammatory and tissue-protective effects. In non-obese rats, topiramate did not induce major histological or serological alterations, indicating its neutral impact under normal physiological conditions.

CONCLUSION: Topiramate demonstrated beneficial effects on ovarian tissue in obese rats by reducing inflammation, improving follicular integrity, and modulating metabolic and hormonal disturbances. Importantly, the drug did not cause adverse outcomes in non-obese rats, highlighting its potential as a safe therapeutic option for obesity-related reproductive dysfunction without compromising ovarian health in non-obese populations.

Keywords: Topiramate, Obesity, Stereology, NF-κB, Ovaries, Rat.

PP-52 - Main Topics in Biological Sciences - Structures and Functions of Cells and Organelles

The effect of ULK1 (unc-51-like autophagy-activating kinase 1) modulation on autophagy in hep3b cells

Kaan Biçici[1], Devrim Öz Arslan[2], Zeynep Aslıhan Oztug Durer[2]

[1]Institute of Health Sciences, Department of Biophysics, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye.

[2]School of Medicine, Department of Biophysics, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye.

AIM: Autophagy is an evolutionarily conserved cellular process that sustains homeostasis by degrading and recycling intracellular components via lysosomes. Beyond this housekeeping role, it is critically involved in energy balance, stress response, and metabolic adaptation (Levine & Kroemer, 2008). Dysregulation of autophagy has been linked to numerous pathological conditions, including cancer, neurodegenerative disorders, and cardiomyopathies (Rubinsztein et al., 2012). ULK1 (Unc-51-like autophagy activating kinase 1) is a serine/threonine kinase that initiates autophagy and integrates upstream signals. This study aims to investigate the effect of pharmacological modulation of ULK1 on autophagic activity in the Hep3B human hepatoma cell line using the ULK1 inhibitor SBI-0206965 and activator BL-918.

MATERIALS-METHODS: Hep3B cells were cultured in DMEM supplemented with 10% FBS and 1% penicillin-streptomycin. Cells were exposed to varying concentrations of SBI-0206965 (1 µM, 2.5 µM, 5 µM, 10 µM, 20 µM) and BL-918 (0.5 µM, 1 µM, 2.5 µM, 5 µM, 10 µM) for 2 hours. Autophagic activity was assessed by measuring LC3B-II levels via Western blotting using anti-LC3B antibody. Additionally, Hep3B cells will be transfected with mEmerald-Vinculin to monitor focal adhesions. The size and number of focal adhesions will be evaluated and imaged by confocal microscopy. This study was supported by Acıbadem MAA University (GAP 2236).

RESULTS: Treatment with BL-918, particularly at 5 µM and 10 µM concentrations, resulted in increased LC3B-II levels consistent with enhanced autophagic activity. Results from SBI-0206965 treatments, designed to evaluate autophagic flux, will be compared with those of Bafilomycin.

CONCLUSION: Preliminary findings from this study demonstrate that autophagy-related protein levels in Hep3B cells can be pharmacologically modulated by the ULK1 inhibitor SBI-0206965 and its activator BL-918. These data will be provided a basis for further studies to understand the regulation of autophagy in cancer cells including changes in focal adhesion dynamics monitored through vinculin.

Keywords: Autophagy, BL-918, Hep3B, LC3B, ULK1 inhibitor

PP-53 - Main Topics in Biological Sciences - Neurobiology

Effects of Vagal Nerve Inhibition on the Amygdala in Female Rats: A Comparative Histopathological and Stereological Study in Control and Obese Groups

Berrin Zühal Altunkaynak[1], Işınsu Alkan[2], Seda Sezer[1], Ceren Erdem Altun[1], Cengiz Bayçu[1]

[1]Department of Histology and Embryology, Faculty of Medicine, Okan University, Istanbul, Turkey

[2]Department of Basic Medical Sciences, Faculty of Dentistry, Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey

OBJECTIVE: The vagus nerve plays a key role in brain-gut communication and emotional regulation. Obesity may alter vagal signalling, potentially affecting limbic structures such as the amygdala. This study aimed to evaluate the effects of vagus nerve inhibition on the histological structure and volume of the amygdala in female rats, comparing both control and obese groups.

METHODS: Twenty-four adult female Wistar Albino rats (9-10 weeks old, 300-350 g) were divided into three groups; Non-obese-Control (NOC), Obese-Sham (O-Sham), and Obese-Inhibition (O-Inh). NOC group fed by a commercial diet and tap water. The rats in the obese groups fed a 40% high fat diet. At the end of the ninth week, vagus nerve inhibition and sham operation were performed on the experimental groups. In the thirteenth week, the rats were subject to euthanasia under a high dose of anaesthesia. Obtained tissues were analysed by histopathological and stereological methods.

RESULTS: Histological analyses showed that the O-Sham group exhibited pronounced neuronal degeneration, cytoplasmic vacuolization, and increased gliosis. Stereologically measured amygdala volumes were changed significantly in O-Sham and O-Inh groups ($p < 0.05$) by comparison with the NOC group. Neuronal densities of the groups were also different from each other ($p < 0.05$).

CONCLUSION: Vagal nerve inhibition has some structural effects on the amygdala, with more severe outcomes observed in obese rats. These findings suggest that vagal tone plays a neuroprotective role in limbic regions, and its changes can be a treatment alternative under metabolic stress like obesity.

Keywords: Obesity, vagus nerve, amygdala, histopathology, stereology, rat.

PP-54 - Main Topics in Biological Sciences - Cancer Biology

Establishment of Inducible CRISPR/Cas9 System in GlioblastomaCells

Sedanur Yılmaz[1], Yiğit Emre Altın[2], Ipek Kök[2], Tuğba Bağcı Önder[3]

[1]Koç University College of Science, İstanbul, Türkiye

[2]Koç University Research Center for Translational Medicine, İstanbul, Türkiye

[3]Koç University, School of Medicine, İstanbul, Türkiye

AIM: The CRISPR/Cas9 system is modified from the bacterial defense mechanism and applied for accurate genome editing within cells. gRNAs (guide RNAs) are created to complement the specific DNA sequences and direct the Cas9 protein to cut that DNA sequences. With the conventional system, DNA is immediately cut when Cas9 binds to gRNA. Nevertheless, immediate action is not always preferred. Knock out of essential genes cause the quick death of cells. To overcome the essentiality barrier of genes, inducible CRISPR/Cas9 system is established in HEK293T and a glioblastoma cell line.

MATERIALS-METHODS: HEK293T cells are transfected with P-Lix GFP plasmid and exposed to different doxycycline concentrations. HEK293T cells are transfected with PcW Cas9 plasmid and Cas9 activity is examined in different time intervals. Then, Tet/Cas9 system is introduced into A172 cells with PcW Cas9's lentiviral transduction and Cas9 activity is examined on different days. The GFP extinction by time is examined with P-Lix GFP infection with Tet/Cas9 system. Additionally, RPL11, an essential gene, is knocked out with Tet/Cas9 system and PLCV2, as a control. Cas9 activity in A172 cells are examined with the classic CRPSPR/Cas9 system with flow cytometry by knocking out the GFP gene and applying an NT (non-targeting) gRNA as a control. As a future direction, Cas9 activity assay will be examined with Tet/Cas9 system.

RESULTS: The optimal doxycycline dose is determined as 2 µg/mL. With the Tet/Cas9 system, Cas9 activity begins after doxycycline exposure and increases with time. Doxycycline is optimally effective for 2 days, then, its effect disappears. It is demonstrated with the colony formation assay that Tet/Cas9 system successfully knocks out the genes and causes loss of cell viability as comparable to PLCV2. Cas9 activity is demonstrated with loss of GFP fluorescence after knocking out of GFP with the classic system, via flow cytometry.

Keywords: Inducible, CRISPR/Cas9, glioblastoma, Hek293T

PP-55 - Main Topics in Microscopy Techniques - Transmission Electron Microscopy (TEM)

An ultrastructural study on the ovarian and uterine effects of allium cepa extract in chronically DHEA-administered rats

Said Bahadır Aslan[1], Hakan Sahin[1], Yasemin Ersoy Canillioglu[2], Gozde Erkanli Senturk[1]

[1]Istanbul University- Cerrahpasa, Cerrahpasa Faculty of Medicine, Department of Histology and Embryology

[2]Bahcesehir University, School of Medicine, Department of Histology and Embryology

INTRODUCTION: Dehydroepiandrosterone (DHEA), a steroid hormone synthesized in the adrenal glands and liver, serves as a crucial precursor in both androgen and estrogen biosynthesis. DHEA is utilized in a broad spectrum of medical and physiological applications, including the treatment of sexual dysfunction, the mitigation of menopausal symptoms, body weight regulation, and the potential enhancement of athletic performance. Within this context, the metabolic and endocrine effects of DHEA administration on the ovaries and uterus have been extensively investigated in the existing literature.

Allium cepa (AC), commonly known as the onion, is distinguished by its rich content of nutritional and bioactive phytochemicals, such as flavonoids, flavonol glycosides, phenolic compounds, and organosulfur compounds. This unique composition attributes various biological activities to AC, most notably its antioxidant, anti-inflammatory, and enzymatic inhibitory properties. With its deep-rooted history in traditional medicine and its prominent role in the human diet, AC has been the subject of numerous studies examining its effects on a variety of pathological conditions.

AIM: The present study aimed to investigate the ultrastructural alterations in the ovarian corpus luteum and the surface epithelium, stroma, and glands of the uterus following chronic administration of DHEA and DHEA+AC to rats.

MATERIALS-METHODS: The findings were obtained through transmission electron microscopy examinations.

RESULTS: In the DHEA+AC group, the number of dark lipid droplets was statistically significantly decreased compared to the control group ($p<0.05$). Furthermore, it was notable that the density of white lipid vesicles in the uterine surface epithelium was markedly increased in the DHEA+AC group relative to the control group ($p<0.05$).

CONCLUSIONS: These ultrastructural findings suggest that Allium cepa extract modulates cellular metabolic activity in the ovarian and uterine tissues of rats chronically treated with DHEA.

Keywords: Dehydroepiandrosterone, Allium cepa, Ovary, Uterus, Ultrastructure

PP-57 - Main Topics in Biological Sciences - Tissues and Systems

Potential therapeutic effect of ferulic acid in monosodium glutamate-induced gastric injury

Begum Ozefe[1], Anıl Can[2], Gokcen Ozgun[3], Samed Ozer[4], Serap Arbak[2], Merve Acıkel Elmas[2]

[1]Acibadem Mehmet Ali Aydinlar University, School of Medicine, Year 6, Istanbul, Turkiye

[2]Acibadem Mehmet Ali Aydinlar University, School of Medicine, Department of Histology and Embryology, Istanbul, Turkiye

[3]Acibadem Mehmet Ali Aydinlar University, Institute of Health Sciences, Department of Biotechnology, Istanbul, Turkiye

[4]Acibadem Mehmet Ali Aydinlar University, Animal Application and Research Center, Istanbul, Turkiye

AIM: Monosodium glutamate (MSG), a widely used flavour enhancer, can induce oxidative stress and lead to gastrointestinal complications. Ferulic acid (FA), a plant-derived antioxidant with anti-inflammatory properties, has shown beneficial effects on the regulation of digestive enzymes and holds promise for medical food applications. Zonula occludens-1 (ZO-1), a key tight junction protein, plays a critical role in maintaining the integrity of the intestinal barrier. This study investigates the therapeutic potential of FA against MSG-induced gastric lesions using microscopic techniques.

METHOD: Wistar albino rats were divided into five groups: Control, FA, MSG, MSG+SF, and MSG+FA. The Control group received distilled water for 38 days. The FA group received distilled water for the first 28 days, followed by 25 mg/kg FA via oral gavage once daily for the last 10 days. The MSG group received 600 mg/kg MSG once daily for 28 days by oral gavage. The MSG+SF group received MSG once daily for the first 28 days, followed by SF once daily for 10 days. The MSG+FA group received MSG once daily for 28 days, followed by 25 mg/kg FA once daily for 10 days. At the end, gastric tissues were embedded in paraffin for histopathological examination and evaluation of ZO-1 immunofluorescence distribution. In addition, scanning electron microscopy was performed for morphological analysis.

RESULT: Normal gastric morphology was observed in the Control and FA groups. The MSG group showed significant gastric mucosal damage, whereas FA- and SF-treated groups showed ameliorated tissue morphology. Immunofluorescence analysis indicated altered ZO-1 distribution in the MSG group, which was improved in the MSG+FA group.

CONCLUSION: FA exhibited a protective effect against MSG-induced gastric injury. These findings suggest that FA preserves gastric morphology by reducing oxidative stress and may contribute to experimental research on therapeutic strategies for gastric damage.

Keywords: Ferulic acid, gastric damage, MSG

EMK 2025
BİYOLOJİK BİLİMLER PROGRAMI

26 EYLÜL 2025

09:00-18:00	**KAYIT**
11:00-12:30	**Prof. Dr. Aymelek Yalın'ın Anısına- Açılış Konferansı (D104 Salonu)** Oturum Başkanları: **Yurdagül Canberk, Güngör Şatıroğlu, Faruk Alkan** Akademik Duruş **Ramazan Demir**
	BB 1-Sözlü Sunumlar (D104 Salonu) Oturum Başkanı: **Hilal Kabadayı Ensarioğlu**
11:50-12:00	**SS-0024** **Begüm Şahin** BALB/c tip farelerde aspartamla indüklenen karaciğer hasarında fenilboronik asit ve eksozomun TGF-β-Smad/REDD1 yolağı üzerindeki iyileştirici etkilerinin araştırılması
12:00-12:10	**SS-0050** **Hülya Ece Kuyucu** Krosinin alfanaftiltioüre ile indüklenen akut akciğer hasarında histopatolojik ve immünohistokimyasal etkilerinin değerlendirilmesi
12:10-12:20	**SS-0061** **Nur Özkeçeci** TNBS ile indüklenen deneysel kolit modelinde irisin ve NO düzenleyicilerinin anti-inflamatuvar ve antioksidan rolleri
12:20-12:30	**SS-0056** **Selda Kahveci** Ovaryum dokusunda pannexin 1 ekspresyonunun karakterizasyonu ve in vitro oosit maturasyonundaki rolü
12:30-13:30	**POSTER OTURUMU**
13:30-14:30	**ÖĞLE YEMEĞİ ARASI**
14:30-16:00	**BB 1. Oturum (D104 Salonu)** Oturum Başkanları: **Ramazan Demir, Yener Aytekin**
14:30-15:00	**Gamze Tanrıöver (Davetli Konuşmacı)** Glioblastoma Tedavisinde İnhibitörlerin Rolü: Kemoterapiye Alternatif mi, Destek mi?
15:00-15:30	**Gamze Güney Eskiler (Davetli Konuşmacı)** Lipid-Polimer Hibrit Nanopartiküller ile Hücre Siklusunun Hedeflenmesi: Triple Negatif Meme Kanserinde Moleküler Perspektifler
	BB 2-Sözlü Sunumlar (D104 Salonu) Oturum Başkanı: **Aysun Özbay Önal**
15:30-15:40	**SS-0039** **Hacer Ağar** Mesane kanserinde PI3K/AKT/mTOR sinyal yolağı inhibisyonunun potansiyel terapötik etkisinin araştırılması
15:40-15:50	**SS-0041** **Gizem Vardar** Wee1 kinaz inhibisyonunun metastatik prostat kanseri hücrelerinde moleküler ve mikroskobik düzeyde etkisinin araştırılması
16:30-17:00	**KAHVE ARASI**

26 EYLÜL 2025

17:00-18:30	**BB 2. Oturum (D104 Salonu)** Oturum Başkanı: **Gülam Hekimoğlu**
17:00-17:30	**Elif Nedret Keskinöz (Davetli Konuşmacı)** Deneysel Alzheimer Modelinde mitokondriyal morfoloji ve sinaptik değişikliklerin mikroskobik analizi
17:30-18:00	**Devrim Öz Arslan (Davetli Konuşmacı)** Alzheimer transgenik fare modeli hipokampus dokusundaki lipid değişimleri
18:00-18:30	**Ekin Döngel Dayanç (Davetli Konuşmacı)** Zebra Balığında Bilişsel İşlevlerin Davranışsal Analizi
20:00	**GALA YEMEĞİ**

27 EYLÜL 2025

09:00-18:00	**KAYIT**
11:00-12:30	**BB 3. Oturum (D104 Salonu)** Oturum Başkanı: **Yosun Mater**
11:00-11:30	Nanoboyutlu İlaç Taşıyıcılarında Görüntüleme Stratejileri ve Uygulamaları **Gülen Melike Demirbolat (Davetli Konuşmacı)**
	BB 3-Sözlü Sunumlar (D103 Salonu) Oturum Başkanı: **Işınsu Alkan**
11:30-11:40	**SS-0066** **Ayşe Hande Yozgat** Prepuberte ve puberte döneminde Wistar albino sıçanların ovaryum dokusunda speksin ekspresyon düzeylerinin immün-altın ve immünhistokimya işaretleme ile incelenmesi
11:40-11:50	**SS-0018** **Başak Işıldar** İnsan göbek kordonu kökenli mezenkimal kök hücrelerde mitokondri dinamiklerinin elektron mikroskobu ile değerlendirilmesi
11:50-12:00	**SS-0023** **Merve Yildirim** İnsan Akciğer Fibroblastlarında Kolşisin Aracılı Miyofibroblast Farklılaşmasının Geriletilmesi
12:00-12:10	**SS-0086** **Tülay Mortaş** Psoriasis Hastalarında Eritrosit Deformabilitesi
12:30-13:30	**ÖĞLE YEMEĞİ ARASI**
14:00-15:30	**BB 4.Oturum (D104 Salonu)** Oturum Başkanı: **Tülay Mortaş**
14:00-14:30	Biyolojik Numunelerde Elementel Analiz: Enerji Dağılımlı X-Işını Spektroskopisi **Olgu Enis Tok (Davetli Konuşmacı)**
	BB 4-Sözlü Sunumlar (D104 Salonu) Oturum Başkanı: **Selenay Furat**
14:30-14:40	**SS-0049** **Aslınur Kaya** Fulvestrantın Nesfatin-1 Nöronlarında Östrojenin Oluşturduğu Aktivasyonu Baskılayıcı Etkisinin İmmünohistokimyasal Olarak Araştırılması
14:40-14:50	**SS-0109** **Yosun Mater** Karides Atıklarından Biyolojik Kitosan Üretimi ve Üretilen Kitosanın Biyolojik Uygulamalarda Değerlendirilmesi
14:50-15:00	**SS-0080** **Elif Kervancıoğlu Demirci** Geçirimli Elektron Mikroskopisinin (TEM) virüs araştırmaları,aşı ve hiperimmun antiserum geliştirme çalışmalarında kullanımı
15:00-15:10	**SS-0128** **Sezin Çevik** Deneysel Sinir Yaralanmalarında Nöral Mobilizasyonun Etkisinin Morfolojik Olarak İncelenmesi
16:00-16:30	**KAHVE ARASI**
17:30-18:00	**KAPANIŞ VE ÖDÜL TÖRENİ (Konferans Salonu)**

DAVETLİ KONUŞMACI SUNUMLARI

Glioblastoma Tedavisinde İnhibitörlerin Rolü: Kemoterapiye Alternatif mi, Destek mi?

Gamze Tanriover

Akdeniz Üniversitesi, Histoloji ve Embriyoloji Ana Bilim Dalı, Tıp Fakültesi, Antalya

Glioblastoma (GBM), merkezi sinir sisteminde ortaya çıkan en yaygın ve en agresif kanser türüdür. Klinik tedavi yaklaşımı, maksimum cerrahi rezeksiyonun ardından radyoterapi ve kemoterapi uygulanmasını içerir. Temozolomid (TMZ), kemoterapötik ajan olarak kullanılan bir alkilleyici ajandır. Ancak GBM'nin klinik, histolojik ve moleküler heterojenitesi, kök hücre benzeri özellikleri ve tümör hücrelerinin mutasyon biriktirme eğilimi nedeniyle, hastalarda sıklıkla TMZ'ye karşı direnç gelişmekte ve bu durum GBM prognozunu olumsuz yönde etkilemektedir.

Güncel terapötik yaklaşımlar, kanser hücrelerindeki aşırı aktif reseptör tirozin kinazların (RTK'ler) hedeflenmesine odaklanmakta ve böylece proliferasyon, sağkalım, migrasyon ve anjiyogenezde rol alan temel sinyal yolaklarının hedeflenmesi amaçlanmaktadır. Çalışmamızda, "Yeni bir küçük molekül multikinaz inhibitörünün, GBM'de aşırı ekspre olan Vasküler Endotelyal Büyüme Faktörü Reseptörü (VEGFR) ve Mezenkimal-Epitel Geçiş Faktörü (c-MET) aracılı sinyal yolaklarını inhibe ederek hücrelerin sağkalım, proliferasyon, invazyon ve anjiyogenezini kısıtlar." hipotezinden yola çıkarak kurgulanmıştır.

Multikinaz inhibitörünün IC50 değerleri, TMZ'ye duyarlı (U87MG) ve TMZ'ye dirençli (T98G ve GL261) hücreler için belirlenmiştir. Hücreler, bu IC50 dozlarıyla tek başına ve TMZ ile kombinasyon halinde muamele edilerek hücre canlılığı, proliferasyon, migrasyon ve invazyon üzerindeki etkiler değerlendirilmiştir. Hasta-kaynaklı GBM hücreleri ve insan normal astrosit hücreleri multikinaz inhibitörünün belirlenen IC50 değeri ile bireysel ve TMZ ile kombine muamele edilerek hücre canlılığı değerlendirilmiştir. Ayrıca, çoklu kinaz inhibitörünün VEGFR ve c-MET sinyal yolakları üzerindeki etkisi belirlenmiştir. *In vivo* ortotopik GBM modeli, C57BL/6 farelerinin sağ striatumuna GL261 hücrelerinin ($8x10^4$ hücre/1 µl) implante edilmesiyle oluşturulmuştur. GBM oluşumu manyetik rezonans görüntüleme (MR) ve histolojik değerlendirmeler ile doğrulanmıştır.

In vitro deneyleri büyük ölçüde tamamlanarak *in vivo* aşamaya geçmiş olduğumuz çalışmamızda, tümör büyümesini ve progresyonunu baskılamak amacıyla GBM'de aşırı aktif ekspre edilen RTK'ler hedeflenmiştir. Elde edilen bulguların, TMZ'ye alternatif ya da tamamlayıcı nitelikte terapötik stratejilerin geliştirilmesine katkı sağlaması beklenmektedir.

Anahtar Kelimeler: Glioblastoma, Reseptör tirozin kinaz inhibitörleri, Temozolomid

Lipid-Polimer Hibrit Nanopartiküller ile Hücre Siklusunun Hedeflenmesi: Triple Negatif Meme Kanserinde Moleküler Perspektifler

Gamze Güney Eskiler

Sakarya Üniversitesi, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

Triple negatif meme kanseri (TNMK), meme kanserinin bir alt tipidir ve agresif yapısı ve yüksek heterojenitesi nedeniyle hastalarda kötü prognoza ve konvansiyonel kemoterapötik ilaçlara karşı direnç gelişmesine yol açmaktadır. Kanser hücrelerinin kontrolsüz çoğalması, hücre döngüsü kontrolünün düzensizliği ile yakından ilişkilidir. Bu nedenle, hücre döngüsünü kontrol eden proteinlerin hedeflenmesi, kanser tedavisinde önemli bir terapötik strateji olarak kabul edilmektedir.

Siklin bağımlı kinazlar 4 ve 6'nın (CDK4/6) spesifik aktivitesi kanser hücrelerinin kontrolsüz proliferasyonu ile önemli ölçüde ilişkilidir. İnsan tümörlerinin yaklaşık %80'inde siklin D-CDK4/6-RB yolağında anormal aktivite, CDK4/6 inhibitörlerinin geliştirilmesine yol açmıştır. Palbosiklib, ribosiklib ve abemasiklib gibi CDK4/6 inhibitörleri, hormon reseptörü pozitif metastatik meme kanserlerinin tedavisinde klinikte kullanılmakta ve farklı tümör tiplerinde klinik çalışmaları devam etmektedir. Ancak, bu inhibitörlerin neden olduğu ciddi yan etkiler, farmakokinetik ve farmakodinamik sınırlamaları ve gelişen ilaç direnci klinik başarılarını sınırlamaktadır.

Lipid polimer hibrit nanopartiküller (LPHNP'ler), lipozomların ve polimerik nanopartiküllerin avantajlarını bir araya getiren yenilikçi bir ilaç taşıyıcı sistemdir. LPHNP'lerin çekirdek-kabuk yapısı, ilaç stabilitesi ve biyoyararlanım artmasına, yüksek ilaç yükleme kapasitesine ve hedeflenmiş hücresel ilaç birikimi sağlamaktadır. Literatürde, farklı kemoterapötik ajan yüklü LPHNP'lerin TNMK hücrelerinde hücre döngüsünün durmasında, apoptozun indüklenmesinde ve in vivo modellerde tümör büyümesinin engellenmesinde terapötik öneme sahip olduğu gösterilmiştir.

Gelecekteki preklinik ve klinik araştırmalar, CDK4/6 inhibitörleri yüklü LPHNP'lerin TNMK tedavisinde translasyonel potansiyeline ve hücre döngüsünü hedefleyen yeni tedavi stratejilerine odaklanmalıdır.

Anahtar Kelimeler: Triple negatif meme kanseri, CDK4/6 inhibitörleri, Lipid polimer hibrit nanopartiküller.

Deneysel Alzheimer Modelinde Mitokondriyal Morfoloji ve Sinaptik Değişikliklerin Mikroskobik Analizi

Elif Nedret Keskinoz

Department of Anatomy, School of Medicine; Institute of Health Sciences, Acibadem University, Istanbul, Turkiye

Alzheimer hastalığının erken evrelerinden itibaren mitokondriyal fonksiyon bozuklukları ve sinaptik kayıplar hastalık progresyonunun merkezinde yer almaktadır. Mitokondriler enerji üretimi, kalsiyum dengesinin düzenlenmesi ve hücresel homeostaz için kritik öneme sahiptir. Sinapslar ise nöronal iletişimin merkezinde bulunur ve öğrenme, bellek ile bilişsel işlevlerin sürdürülmesi açısından temel yapılardır. Bu düzeylerde ortaya çıkan erken bozulmalar, nörodejeneratif sürecin başlamasında ve ilerlemesinde belirleyici rol oynamaktadır. Deneysel hayvan modelleri, yaşa ve genotipe bağlı olarak gelişen bu değişimlerin ayrıntılı incelenmesine olanak sağlayarak patolojik sürecin anlaşılmasında güçlü bir araştırma platformu oluşturmaktadır.

Bu çalışmada Alzheimer'ın deneysel modellerinde hipokampal bölgede yapısal ve moleküler düzeydeki değişiklikler çok yönlü yöntemlerle incelenmiştir. Mitokondriyal morfoloji hem 3xTg hem de 5xFAD transgenik farelerde elektron mikroskobi ile değerlendirilmiş; ultrastrüktürel incelemeler bozulmuş mitokondriyal yapılar, mitochondria-on-a-string formasyonları ve organel etkileşimlerindeki düzensizlikleri ortaya koymuştur. Ek olarak 5xFAD modelinde flow sitometri analizleri gerçekleştirilmiş, membran potansiyeli ve mitokondriyal kütlede azalma ile oksidatif stres parametrelerinde artış gözlenmiştir. Sinaptik bütünlük ise western blot ve konfokal mikroskobi yöntemleriyle araştırılmış; erken evrelerden itibaren belirginleşen değişiklikler protein düzeyinde gösterilmiş, konfokal bulgular bu farklılıkların dokudaki dağılım paternlerini desteklemiştir.

Elde edilen veriler, Alzheimer modellerinde mitokondriyal bozulmaların erken evrelerden itibaren başladığını ve sinaptik bütünlükteki değişikliklerle sürece eşlik ederek ilerleyen dönemlerde patolojik tablonun derinleşmesine katkıda bulunduğunu göstermektedir. Hücresel enerji dengesi ve sinaptik bütünlüğe odaklanan bu çok yönlü değerlendirme, Alzheimer hastalığının mekanizmalarının daha iyi anlaşılmasına katkı sağlamakta, nörodejeneratif süreçlerin çok boyutlu doğasını vurgulamakta ve erken tanıda kullanılabilecek potansiyel biyobelirteçlerin belirlenmesine ışık tutmaktadır.

Anahtar Kelimeler: Alzheimer's Disease, 5xFAD, mitochondria, synapse,

Alzheimer transgenik fare modelinde hipokampus dokusundaki lipid değişimleri

Devrim Öz Arslan

Acıbadem Mehmet Ali Aydınlar Üniversitesi, Tıp Fakültesi, Biyofizik Ana Bilim Dalı, İstanbul

GİRİŞ: Alzheimer hastalığı (AH), amiloid beta (Aβ) plakları, nörofibriler yumaklar (NFT'ler) ve kronik inflamasyon ile karakterize, patogenezi halen tam olarak aydınlatılamamış nörodejeneratif bir hastalıktır. Son yıllarda, lipid metabolizmasındaki bozulmaların AH'nin erken evrelerinde önemli rol oynadığına dair güçlü kanıtlar ortaya konmuştur. Lipidler, membran bütünlüğü, sinaptik ileti ve Aβ agregasyonu gibi süreçlerde kritik işlev görmektedir. Bu nedenle lipid profillerinin değerlendirilmesi, hastalığın moleküler mekanizmalarının anlaşılmasına katkı sağlayabilir.

AMAÇ: Bu çalışmada, ailesel AH modeli olan 5XFAD transgenik fareler ile kontrol farelerin hipokampüs dokularındaki lipid değişimlerinin lipidomik analiz ile belirlenmesi ve miyelin kılıf yapısının elektron mikroskobu ile incelenmesi amaçlanmıştır.

YÖNTEM: Transgenik 5XFAD ve kontrol fareler genotipleme ile birbirinden ayrılmıştır. 3, 6 ve 9 aylık farelerden elde edilen hipokampüs dokuları kantitatif kütle spektroskopisi temelli shotgun lipidomik yöntemi ile analiz edilerek, veriler GraphPad Prism, Python ve R yazılımları kullanılarak değerlendirilmiştir. Hipokampüsün CA1 bölgesi ise transmisyon elektron mikroskobu (TEM) ile incelenerek (alan temelli G-Ratio ölçüm yöntemi kullanılarak) miyelin kılıf kalınlığı ölçülmüştür.

BULGULAR: Transgenik ve kontrol farelerin hipokampüs dokusu lipid kompozisyonu incelendiğinde 33 lipid sınıfı içinde 571 farklı lipid türü tanımlanmıştır. Transgenik farelerde kontrollere göre 25 lipid türünde anlamlı artış, 11 lipid türünde ise azalma gözlenmiştir. Fosfatidilkolin (PC) 6. ayda belirgin düşüş göstermiş ve bu eğilim 9. ayda da devam etmiştir. Buna karşın DAG, PE O-, PI O- ve TAG lipidleri transgenik farelerde anlamlı şekilde artmıştır. Miyelin kılıf kalınlığı karşılaştırıldığında ise gruplar arasında istatistiksel fark bulunmamış; ancak TEM görüntüleri dejeneratif değişikliklere işaret etmiştir.

SONUÇ: Bulgular, 5XFAD modelinde lipid sınıfı değişikliklerinin hem yaşa hem de lipid türüne özgü olduğunu göstermektedir. Lipid homeostazındaki bozulmaların oksidatif stres, inflamatuar süreçler ve hipokampal sinaptik aktivite değişimleriyle ilişkili olabileceği düşünülmektedir

Anahtar Kelimeler: Alzheimer, lipidomik, miyelin kılıf

Zebra Balığında Bilişsel İşlevlerin Davranışsal Analizi

Ekin Dongel Dayanc

Acıbadem Mehmet Ali Aydınlar Üniversitesi, Fizyoloji Ana Bilim Dalı, İstanbul

Zebra balığı, bilişsel süreçlerin araştırılmasında giderek daha fazla kullanılan güçlü bir model organizmadır. Bu türde, öğrenme ve hafıza temelli deneyler olan koşullu yer tercihi ve klasik korku koşullanması testlerinin yanı sıra, anksiyete davranışları ve çalışma belleği gibi daha karmaşık işlevlerin de değerlendirilebilmesi mümkündür. Bu özellikleri sayesinde zebra balığı, hem temel nörobilim araştırmaları hem de nöropsikiyatrik bozuklukların modellenmesi için değerli bir araç sunmaktadır.

Çalışmamızda, zebra balığında şimdiye kadar oldukça sınırlı olarak incelenmiş bir hedef olan grup III metabotropik glutamat reseptörlerine (mGluR) odaklandık. Bu reseptörlerin beynin belirli bölgelerinde eksprese olduğu ve türler arasında yüksek oranda korunduğu bilinmektedir. Deneylerimizde, mGluR aktivitesinin farmakolojik olarak bloke edilmesi sonucunda bu bölgelerde nöronal aktivitenin arttığını gözlemledik. Bu bulgu, söz konusu reseptörlerin sinirsel devrelerin dengelenmesinde önemli bir rol üstlenebileceğini düşündürmektedir.

Davranışsal düzeyde bu değişimin nasıl yansıdığını anlamak için light–dark stimulation (LDS) ve Y-maze gibi paradigmalar kullandık. Bu testler, zebra balığında olduğu kadar memelilerde de yaygın kullanılan, anksiyete ve bilişsel işlevleri ölçmeye yönelik güçlü araçlardır. Böylece mGluR modülasyonunun davranışsal etkilerini karşılaştırmalı bir perspektifte değerlendirme imkânı bulduk.

Şuan aktif çalışmamızda, kronik bir nöbet modeli geliştirerek bu davranış testlerini epileptik koşullar altında uygulamaktayız. Bu yaklaşım sayesinde, epilepsinin hem nöronal aktivite hem de davranışsal sonuçlar üzerindeki etkilerini ortaya koymayı hedefliyoruz.

Anahtar Kelimeler: zebra balığı, mGluR, anksiyete, çalışma belleği, epilepsi

Nanoboyutlu İlaç Taşıyıcılarında Görüntüleme Stratejileri ve Uygulamaları

Gülen Melike Demirbolat

Acibadem Mehmet Ali Aydınlar Üniversitesi, Farmasotik Teknoloji Ana Bilim Dali, Istanbul

Nanoboyutlu ilaç taşıyıcı sistemler son yıllarda oldukça geniş kullanım alanı bulunan olan yeni nesil ilaç sistemleridir. Çapları 1000 nanometre altındaki, genellikle de 1–100 nanometre arasındaki yapılardır. Yapısal farklılıklarına göre organik ve inorganik yapılar olarak sınıflandırılırlar. Organik yapılılar arasında en yaygın olarak bilinenleri lipozomlar, polimerik nanopartiküller veya misellerdir. inorganik yapılı olanlar arasında ise altın, gümüş veya demir oksit nanopartikulleri, kuantum noktaları, karbon nanotüpler sayılabilir. Tüm bu yapılar, ilaç taşıyıcı olarak ilaçların vücutta daha kontrollü ve hedefe yönelik taşınmasına olanak sağlar. Ayrıca ilaçların çözünürlüğünü artırma, biyoyararlanımını iyileştirme, farmakokinetik özelliklerini değiştirme ve yan etkileri azaltma gibi avantajlar sunarlar. Üretimleri yanı sıra karakterizasyonları tasarım optimizasyonu açısından kritiktir.

Karakterizasyon çalışmaları çok geniş kapsamlı bir araştırmayı gerektirmekle birlikte şekillerinin ve hücresel etkileşimlerinin incelenmesine yönelik çalışmalar terapötik etkinliklerinin değerlendirilmesi açısından önemli bir yer tutar. Nanotaşıyıcıların şekli; ortalama boyutlarını, dağılımlarını, homojenitelerini ve hatta biyolojik açıdan hücre alım verimlilikleri gibi pek çok parametreyi etkiler. Elektron mikroskopisi, nanobüyüklükte ilaç taşıyıcı sistemlerin yapısal özelliklerini ve hücrelerle etkileşimlerini incelemede kritik bir rol oynar. Geçirimli Elektron Mikroskobu (TEM), nanotaşıyıcıların boyut, şekil, iç yapı ve dağılım gibi morfolojik özelliklerini yüksek çözünürlükle analiz etmeye olanak tanır. Öte yandan, Taramalı Elektron Mikroskobu (SEM), nanotaşıyıcıların yüzey morfolojisi ve hücre yüzeyiyle etkileşimlerini üç boyutlu perspektifte analiz etmeye olanak sağlar. SEM-EDS ile birlikte ise nanotaşıyıcıların elementel düzeyde analizi mümkündür. Bunun dışında atomik kuvvet mikroskobu (AFM) yüzeyin topografik haritasını çıkarabilir, floresan mikroskobu ise nanotaşıyıcılarin floresan ile işaretlenmesi ile hücre içi alım süreçlerinin izlenmesine olanak tanır. Konfokal lazer taramalı mikroskop ile ise nanotaşıyıcıların hücre membranından geçişi, çekirdek ya da organellere lokalizasyonu daha detaylı biçimde izlenebilir. Bu teknikler, hem yapısal hem de fonksiyonel düzeyde çok değerli bilgiler sağlayarak nanotaşıyıcı sistemlerin tasarımı ve optimizasyonuna yön verir. Bu tekniklerin kombinasyon halinde kullanılması, ilaç taşıyıcı sistemlerin daha akıllı, etkili ve güvenli hale getirilmesini sağlamaktadır. Bu sayede, nanoteknoloji destekli tedavilerin klinik başarı şansı da artmaktadır.

Anahtar Kelimeler: nanoboyutlu ilaç taşıyıcı sistemler, nanotaşıyıcılar, mikroskobik görüntülüme teknikleri, morfoloji, hücresel etkileşim

Biyolojik Numunelerde Elementel Analiz: Enerji Dağılımlı X-Işını Spektroskopisi

Olgu Enis Tok[1,2]

[1] Histoloji ve Embriyoloji Anabilim Dalı, İstanbul Medipol Üniversitesi, İstanbul, Türkiye

[2] Sağlık Bilim ve Teknolojileri Araştırma Enstitüsü (SABİTA), İstanbul Medipol Üniversitesi, İstanbul, Türkiye

Enerji Dağılımlı X-Işını Spektroskopisi (EDX), biyolojik numunelerdeki inorganik elementlerin kantitatif ve lokalize olarak analiz edilmesine imkan tanıyan bir tekniktir. Elektron mikroskobu sistemlerine entegre olarak çalışan EDX, özellikle doku ve hücre düzeyinde yüksek çözünürlüklü morfolojik görüntüleme ile eş zamanlı elementel veri elde etme avantajı sunar.

Bu sunumda EDX'in temel prensipleri ve X-ışını spektrumlarının yorumlanması, biyolojik dokular üzerindeki uygulamaları bağlamında ele alınacaktır. Yöntemin biyolojik numunelerdeki avantajları ve sınırlılıkları detaylandırılarak, hangi organ ve hücresel yapıların EDX ile analiz edilebildiği sistematik biçimde aktarılacaktır. Özellikle Zn, Ca, Fe, Cu gibi elementlerin fizyolojik süreçlerdeki işlevleri (ör. çinko: antioksidan rol; kalsiyum: sinyal iletimi; demir: redoks dengesinde rol) üzerinden değerlendirme yapılacaktır.

Nörodejeneratif hastalıklarda (ör. Alzheimer, Parkinson, Wilson) çinko, demir, bakır ve alüminyum gibi elementlerin rolü literatür örnekleri eşliğinde tartışılacak; nöronal yapılarda gözlenen metal birikimlerinin patofizyolojik süreçlerle ilişkisi vurgulanacaktır. Aynı zamanda, testis dokularında quantum dot (QD) konjugatlı antikorlar ile yapılan immünoetiketlemeyi takiben gerçekleştirilen EDX analizlerinden elde edilen örnek veriler paylaşılacaktır. Bu yaklaşımla, hedef proteinlerin konumsal olarak işaretlenmesinin yanı sıra, QD içeriğinde bulunan Cd, Zn ve Se gibi elementlerin EDX aracılığıyla kantitatif olarak tespiti mümkün olmaktadır.

Ayrıca literatürde yer alan farklı doku örneklerinden (örneğin kemik, karaciğer, böbrek, prostat, sperm) elde edilen Geçirimli Elektron Mikroskobu (TEM) tabanlı EDX spektrumları ve element haritalama örnekleri sunularak, yöntemin çok yönlülüğü gösterilecektir. Katılımcılara, EDX'in biyomedikal araştırmalarda tanısal ve deneysel olarak nasıl kullanılabileceğine dair kapsamlı bir perspektif sunulması hedeflenmektedir.

SÖZLÜ BİLDİRİLER

OP-0018 - Biyolojik Bilimler Ana Konuları - Kök Hücre Biyolojisi

İnsan göbek kordonu kökenli mezenkimal kök hücrelerde mitokondri dinamiklerinin elektron mikroskobu ile değerlendirilmesi

Başak Işıldar[1], Serbay Ozkan[2], Meral Koyuturk[3]

[1]Balıkesir Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı

[2]İzmir Katip Çelebi Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı

[3]İstanbul Üniversitesi-Cerrahpaşa, Cerrahpaşa Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı

GİRİŞ: Mezenkimal kök hücreler (MKH), farklılaşma kapasiteleri ve sekretomlarıyla sundukları parakrin terapötik etkiler sayesinde rejeneratif tıbbın umut verici hücresel araçlarıdır. Ancak bu potansiyelin önünde; nakledilen MKH'lerin yaşlanması, apoptoz ve kontrolsüz farklılaşma gibi biyolojik sınırlılıklar yer almaktadır. Bu nedenle, hedeflenen etkilere ulaşmak için MKH'lerin fonksiyonlarının kontrollü biçimde düzenlenmesi gerekmektedir. Son yıllarda enerji metabolizmasından sorumlu mitokondrilerin, metabolik adaptasyon, farklılaşma ve immünomodülasyon gibi süreçlerde MKH işlevlerini belirlediği gösterilmiştir. Fizyolojik durum, ön koşullandırma ve farklılaşma gibi etkenlerin mitokondriyal morfolojide değişikliklere yol açtığı bilinmektedir. Bu morfolojik çeşitlilik, yapısal bir farklılığın ötesinde, mitokondrinin oksidatif fosforilasyon kapasitesi, oksidatif stres ve immün yanıt düzenleme gibi işlevlerini de yansıtabilmektedir. Mitokondrilerin ultrastrüktürel düzeyde sistematik incelenmesi, MKH'lerin biyolojik durumu ve terapötik potansiyelini daha iyi anlamaya olanak tanıyarak, hücre temelli tedavilerde kalite kontrol ve hedeflenmiş uygulamalar için önemli bir zemin sunacaktır.

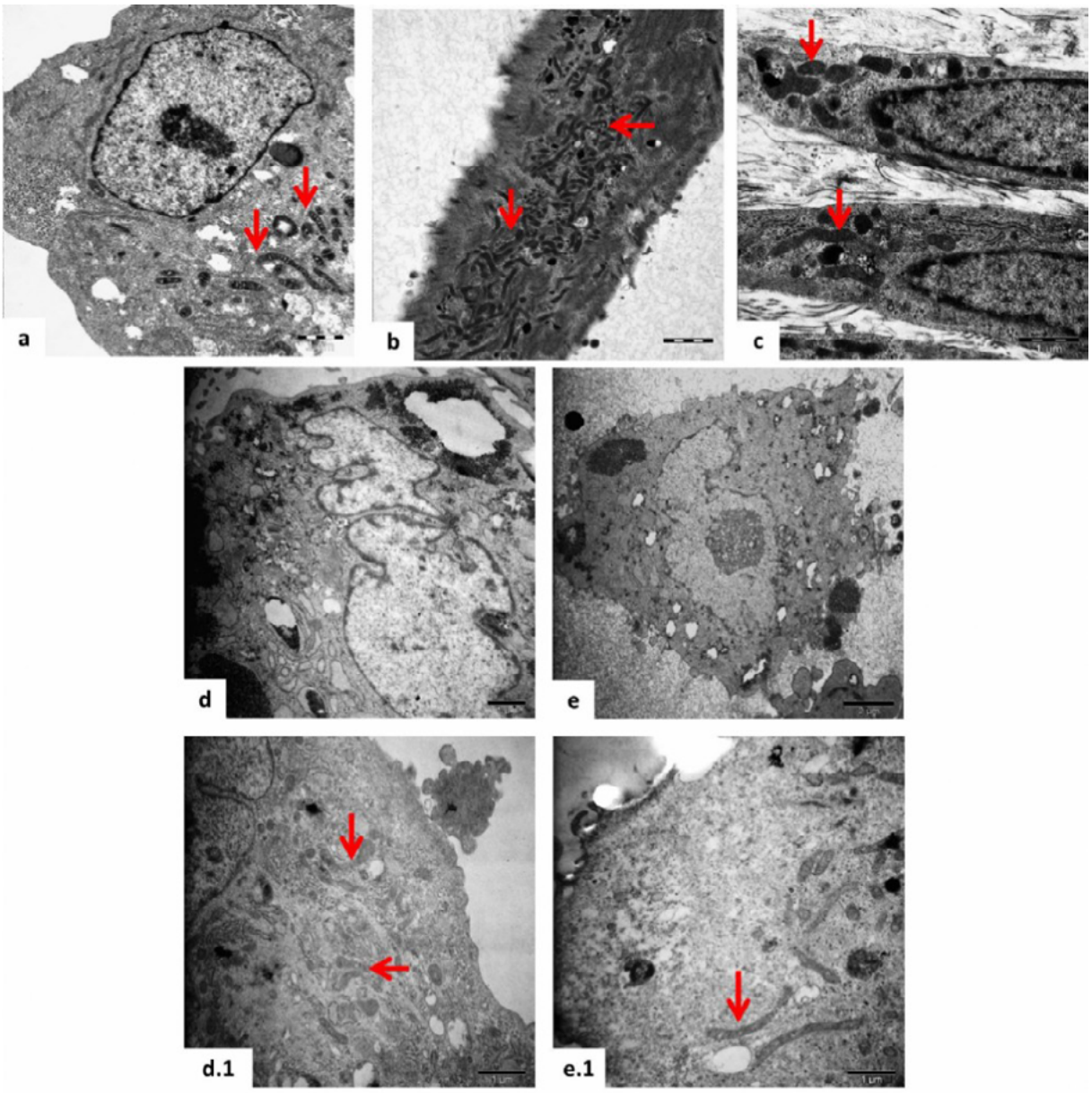
GEREÇ-YÖNTEM: İnsan göbek kordonu MKH'leri; normal, adipojenik ve osteojenik farklılaşma koşulları ile hipoksimimetik [deferoksamin (DFS), kobalt klorür ($CoCl_2$)] ajanlarla ön koşullandırılarak değerlendirildi. Ultrastrüktürel analiz için pelletlenen hücreler fikse edilip agara gömüldü ve 1–2 mm^3'lük parçalara bölündü. Rutin takip sonrası örnekler araldite bloklandı. Kesitler kontrastlanarak mitokondri dinamikleri açısından incelendi.

BULGULAR: Farklı fizyolojik koşullardaki MKH'ler incelendiğinde, normal kültür koşullarında mitokondrilerin perinükleer sitoplazmada yerleştiği ve iyi gelişmiş kristalara sahip olduğu görüldü. Adipojenik farklılaşmada mitokondri sayısı artarken, osteojenik farklılaşmada mitokondrilerin daha uzun ve büyük olduğu saptandı. Her iki durumda da mitokondriler sitoplazmaya yayılmış ve krista yapıları korunmuştu. Hipoksimimetik ajanlarla ön koşullandırılan hücrelerde belirgin mitokondriyal değişiklikler izlendi. Tüm gruplarda mitokondri sayısı anlamlı şekilde azalırken, krista belirginliğini kaybeden mitokondrilerde artış görüldü. Ajanlar ortamdan uzaklaştırıldıktan sonra hayatta kalan hücrelerde füzyon-fisyon dinamiklerinin arttığı, uzamış mitokondrilerin sıklaştığı ve mitofaji benzeri figürlerin daha fazla gözlendiği tespit edildi (Şekil 1).

SONUÇ: Mitokondriler, MKH'lerin yalnızca enerji üretiminde değil, immünomodülasyon ve terapötik etkilerinde de belirleyici organellerdir. Bu çalışmadaki ultrastrüktürel farklılıklar, mitokondriyal morfolojinin metabolizma ve terapötik potansiyelle ilişkili önemli bir biyobelirteç olabileceğini göstermektedir.

Anahtar Kelimeler: Elektron mikroskobu, mezenkimal kök hücre, mitokondriyal morfoloji, ön koşullandırma

Şekil 1



Farklı koşullar altındaki mezenkimal kök hücrelerin (MKH) ultrastrüktürel özelliklerine ait temsili elektron mikrograflar. a: Normal koşullar altındaki MKH. b: Adipojenik farklılaşma durumunda MKH. c: Osteojenik farklılaşma durumunda MKH. d: DFS ile ön koşullandırılmış MKH. d.1: DFS ortamdan uzaklaştırıldıktan sonraki MKH. e: $CoCl_2$ ile ön koşullandırılmış MKH. e.1: $CoCl_2$ ortamdan uzaklaştırıldıktan sonraki MKH. Ok: mitokondri.

OP-0023 - Mikroskopi Teknikleri Ana Konuları - Geçirimli Elektron Mikroskopisi

İnsan Akciğer Fibroblastlarında Kolşisin Aracılı Miyofibroblast Farklılaşmasının Geriletilmesi

Merve Yildirim[1], Seyhun Solakoğlu[2], Füsun Öztay[1]

[1]İstanbul Üniversitesi, Fen Fakültesi, Biyoloji bölümü, Moleküler Biyoloji Anabilim Dalı

[2]İstanbul Tıp Fakültesi. Temel Tıp Bilimleri Bölümü. Histoloji ve Embriyoloji Ana Bilim Dalı

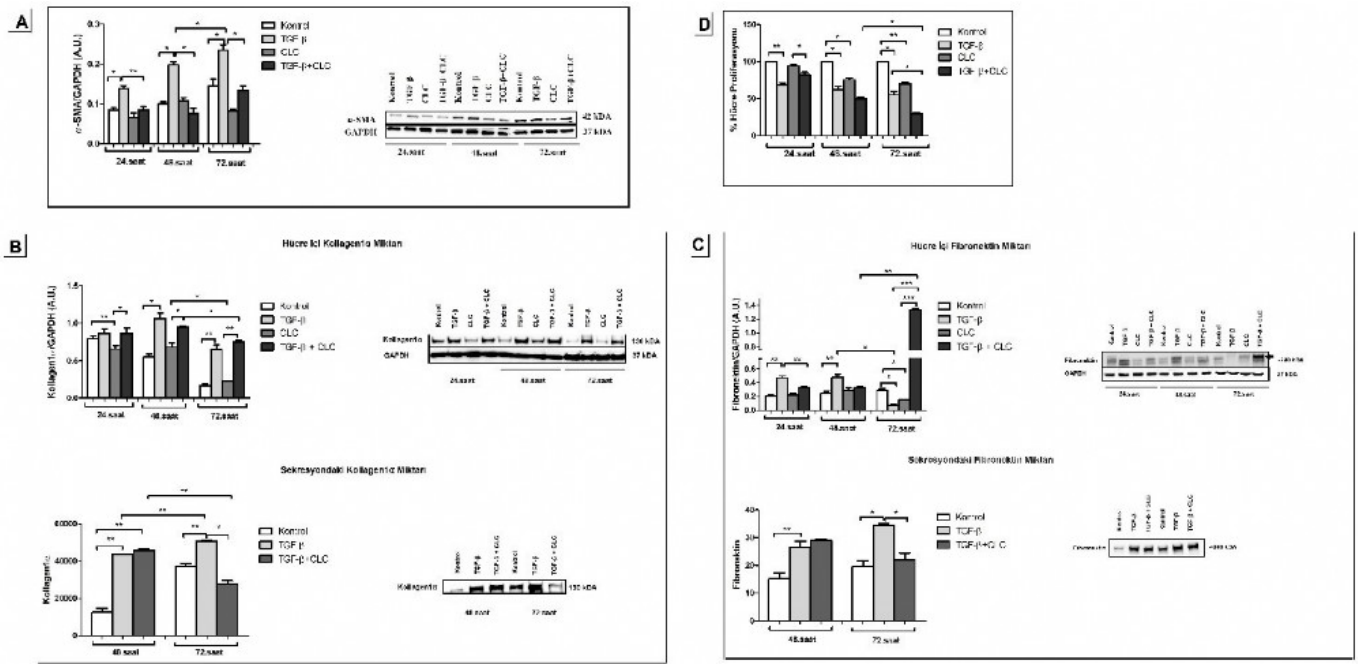
İdiyopatik pulmoner fibrozis (İPF), ilerleyici, kronik ve ölümcül bir interstisiyel akciğer hastalığıdır. Hastalıkta miyofibroblastlar, aşırı ekstrasellüler matriks (ECM) üretimiyle doku fibrozisine neden olur. Mevcut anti-fibrotik yaklaşımlarda, fibroblast/miyofibroblast proliferasyonunun, farklılaşmasının önlenmesi, miyofibroblastların veya matrikste biriken ECM elemanlarının yok edilmesine yönelik uygulamalar yapılmaktadır. Bu çalışmada, kolşisin (CLC) kullanılarak mikrotübül aracılı ECM taşıma mekanizmasının bozulması ve hücre içi stres yoluyla anti-fibrotik yanıtın tetiklenmesi amaçlandı.

MRC-5 insan akciğer fibroblastları dört gruba ayrıldı: kontrol, TGF-β (1 ng/ml) ile uyarılan grup, yalnızca CLC (0,01 µM) uygulanan grup ve TGF-β+CLC birlikte uygulanan grup. CLC'nin etkinliği MTT, BrdU, mikrotübül depolimerizasyonu ve immünofloresan analizlerle belirlendi. Fibrozis, apoptotik ve otofajik yanıtlarla ilgili proteinler Western blot ile analiz edildi. Lizozomal aktivite ve hücresel yapı değişimleri nötral red ve elektron mikroskopisi ile değerlendirildi.

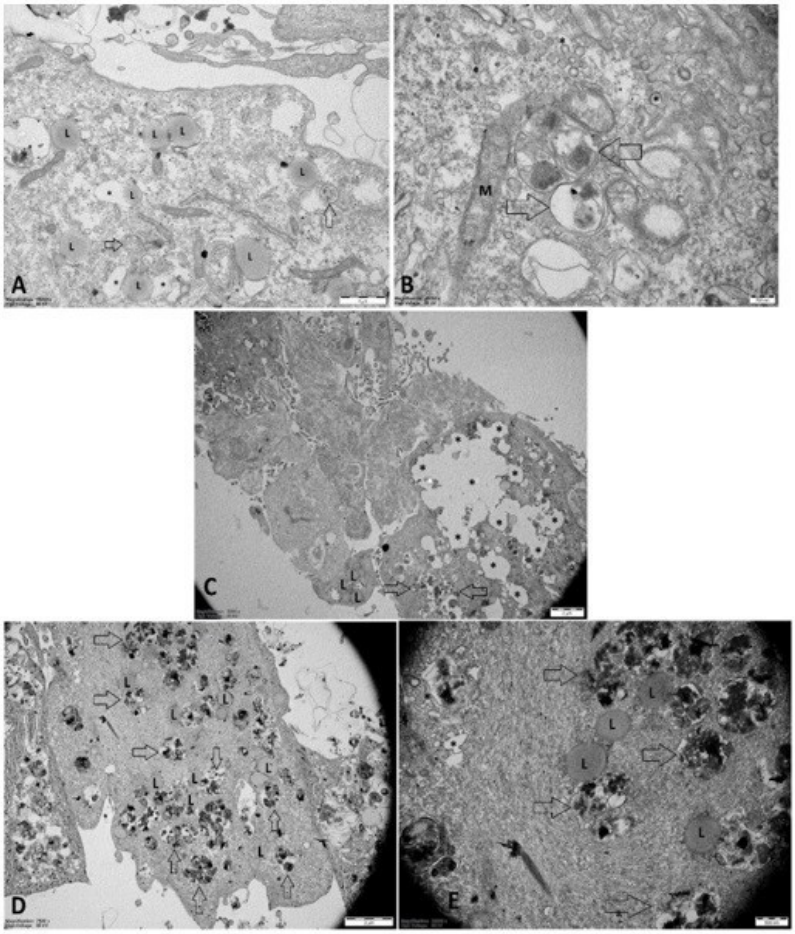
TGF-β, MRC-5 hücrelerinde deneyin hücrelerde α-SMA protein miktarını ($p<0,05$), kollagen (48-72.saatler için $p<0,05$ ve $p<0,01$) ve fibronektin (24-48.saatler için $p<0,01$) gibi ECM elemanlarının üretimini ve hücre dışına ($p<0,01$) salgılanmalarını zamana bağlı olarak uyardı. Aynı zamanda hücrelerin proliferasyon kapasitesini sınırlayarak (24-48-72.saatler için $p<0,01$, $p<0,05$ ve $p<0,05$) ve hücrelerde otofajik sinyalleri azaltarak hücrelerdeki fibrotik yanıtı kuvvetlendirdi. TGF-β ile uyarılan MRC-5 hücreleri üzerinde yapılan CLC uygulamaları, mikrotübül depolimerizasyonunu sağlayarak, hücre içinde ECM elemanlarının birikimine ve özellikle deneyin 72.saatinde, onların hücre dışına salgılanmalarının azaltılmasına neden oldu ($p<0,05$). TGF-β+CLC uygulamaları, TGF-β tarafından proliferasyon kapasitesi azaltılan MRC-5 hücrelerinde farklılaşmanın en düşük seviyede olduğu deneyin 72. saatinde, mevcut hücrelerde proliferasyon yanıtının oluşmasını ve yeniden proliferasyon kapasitesi kazanmalarını engelledi ($p<0,05$). TGF-β+CLC uygulamaları yapılan MRC-5 hücrelerinde aktif kaspaz-3 (48-72.saatler için $p<0,001$), Bax (24-48-72.saatler için $p<0,05$, $p<0,01$ ve $p<0,01$) ve survivin (72.saat için $p<0,05$) protein seviyelerinin düşük olduğu belirlendi. TGF-β+CLC uygulamaları, deneyin 24. saatinden itibaren LC3BI-LC3BII çevrimini uyararak bu hücrelerde otofajik yanıtın gelişmesine neden oldu (24-48-72.saatler için $p<0,001$, $p<0,05$ ve $p<0,01$). Elektron mikroskobik analizler, bu hücrelerde salgı vesiküllerinin birikmesine paralel olarak otofajik vakuol oluşumunun artış gösterdiğini ortaya koydu.

Anahtar Kelimeler: Anti-fibrotik etki, Kolşisin, Miyofibroblast farklılaşması, Otofaji, Pulmoner fibrozis

Şekil 1: Kolşisinin miyofroblast farklılaşması (A), Kollagen ve Fibronektin salınım (B ve C) ve fibroblast/ miyofibroblast proliferasyonu (D) üzerindeki etkisi.



Şekil 2: TGF-β+CLC uygulanan MRC-5 hücrelerinde deneyin 24 (A ve B), 48 (C) ve 72. (D ve E) saatlerinde hücrelerin otafajik yanıtı gösterilmiştir. Hücrelerde zaman ilerledikçe koyu renkli ve büyük otofajik vakuoller görülmektedir. Lizozomların otofajik vakuo



OP-0024 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

BALB/c tip farelerde aspartamla indüklenen karaciğer hasarında fenilboronik asit ve eksozomun TGF-β-Smad/REDD1 yolağı üzerindeki iyileştirici etkilerinin araştırılması

Begüm Şahin[1], Ayşenur Kurt[1], Talat Yasin Acar[1], Barış Cebeci[2], İlknur Keskin[1]

[1]İstanbul Medipol Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Ana Bilim Dalı, İstanbul

[2]İstanbul Medipol Üniversitesi, Tıbbi Araştırmalar Birimi (MEDİTAM), İstanbul

GİRİŞ: Aspartam, dünya genelinde yaygın kullanılan bir yapay tatlandırıcıdır. Aspartamın belirli dozlarının farelerde karaciğer hasarına, nötrofil infiltrasyonuna ve apoptoz belirteçlerinin artışına neden olduğu gösterilmiştir. Çalışmalar özellikle borik asidin, ROS'un varlığını belirleyen sitokinlerin üretimini modüle edebildiğini gösterilmiştir. Aynı zamanda literatürde borik asidin anti-inflamatuar süreçlerde aktif rol oynadığı gösterilmiştir. Ayrıca eksozomlar, hücresel sinyal yollarını düzenleme yetenekleriyle, kanser ve nörodejeneratif hastalıklar gibi hastalıkların tedavisinde terapötik potansiyel taşımaktadır.

AMAÇ: Tüm bu çalışmalar ışığında, aspartamın farelerde karaciğer hasarına sebep olan etkisinin, fenilboronik asitle birlikte kullanılan eksozomların TGF-β-Smad/REDD1 sinyal yolunu etkileyerek karaciğer dokusunu üzerinde olumlu etkisinin gösterilmesi hedeflenmektedir.

YÖNTEM: 42 erişkin erkek Balb/c fare rastgele yedi grubu ayrıldı (N=6/grup). Kontrol grubuna 30 gün boyunca gavajla distile su verildi. Aspartam, aspartam+eksozom, aspartam+fenilboronik asit ve aspartam+eksozom+fenilboronik asit gruplarına 30 gün boyunca 75 mg/kg aspartam gavajla verildi. Aspartam uygulamasından sonraki 1., 7. ve 14. günlerde intraperitoneal olarak eksozom (20 mg/ml) ve gavajla fenilboronik asit (33 mg/kg) uygulandı. Deneyin sonunda fareler sakrifiye edilerek karaciğer dokularının mikroskop analizleri gerçekleştirildi. Parafin kesitler Hematoksilin-eozin, Masson's trikrom ve Pikrosirius Red ile boyandı. Karaciğer doku hasarı; hepatosit sitoplazmasında vakuolizasyon, parankimde lökosit hücre infiltrasyonu ve bağ dokusu artışı gibi kriterlere göre değerlendirildi. Ito hücrelerinin aktivasyonu TNF-α, TGF-β ve MMP-9 ve apoptoz kaspaz-3 immohistokimyasal yöntemlerle değerlendirildi. Karaciğer hasarında etkili TGF-β-Smad/REDD1 sinyal yolağı western blot ile değerlendirildi.

BULGULAR: Karaciğer morfolojisinin kontrol, eksozom ve fenilboronik asit gruplarında normal olduğu gözlenmiştir. Histopatolojik skorlama aspartam grubunda hepatositlerde vakuolizasyonun, lökosit infiltrasyonun ve parankimde kollajen liflerin miktarının arttığını göstermiştir. Tedavi gruplarında histopatolojik skor anlamlı bir şekilde azalmıştır.Tip III kolajen miktarı hasar grubunda azalmıştır. Hasar grubunda TGF-β, TNF-α, MMP-9 ve kaspaz-3 pozitif hücre sayısı artış gözlendi. Western blot analiziyle TGF-β ve Smad2/3 ekspresyon seviyelerinde artış REDD1 seviyelerinde azalma olduğu gösterilmiştir. SONUÇ: Elde edilen veriler eksozom ve fenilboronik asidin aspartam kaynaklı hepatotoksisiteye karşı hem protein hem de histopatolojik düzeyde iyileştirici etkisinin olduğunu göstermiştir.

Anahtar Kelimeler: Karaciğer, aspartam, eksozom, fenilboronik asit, mikroskopi,fibrozis

OP-0039 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Mesane kanserinde PI3K/AKT/mTOR sinyal yolağı inhibisyonunun potansiyel terapötik etkisinin araştırılması

Hacer Ağar[1], Gizem Vardar[2], Gülsüm Reyhan Özakkaş[2], Gamze Güney Eskiler[1]

[1]Sakarya Üniversitesi, Tıp Fakültesi, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

[2]Sakarya Üniversitesi, Sağlık Bilimleri Enstitüsü, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

AMAÇ: Fosfatidilinositol-3-kinaz (PI3K/AKT/mTOR) sinyal yolağı, hücre proliferasyonu, metabolizma, hücre sağ kalımı ve anjiyogenez gibi önemli aktivitelerin düzenlenmesinde rol olan önemli bir yolaktır. PI3K sinyal yolağının aktivitesindeki değişimler kontrolsüz hücre bölünmesi, anti-apoptotik aktivite, anjiyogenez ve direnç mekanizmaları ile ilişkilendirilmektedir. Bu kapsamda PI3K sinyal yolağını hedef alan inhibisyon yaklaşımları terapötik çalışmalarda ön plana çıkmaktadır. Bu çalışmada, PI3K inhibitörü Buparlisib' in mesane kanseri hücrelerindeki terapötik etkisinin araştırılması amaçlanmıştır.

GEREÇ-YÖNTEM: RT-112 ve 5637 mesane kanseri hücre hatları *in vitro* kültür koşullarında çoğaltılmıştır. Hücrelere 0.1-10 µM doz aralığında Buparlisib uygulaması sonrasında CCK-8 analizi ile hücre canlılığı belirlenmiştir. CCK-8 analizi sonucuna göre etkin belirlenen dozlarda Annexin-V analizi ile hücrelerde apoptotik hücre ölümü tespit edilmiştir. Hücrelerde meydana gelen yapısal değişimler AO/PI, mitokondri ve H2DCFDA boyamalarıyla görüntülenmiştir. Ayrıca, PI3K sinyal yolağında rol alan *AKT* ve *mTOR* genlerinin ekspresyon seviyeleri RT-PCR ile analiz edilmiştir.

BULGULAR: CCK-8 analizi sonuçlarına göre Buparlisib' in artan dozuna bağlı olarak RT-112 (5 µM: %51.8) ve 5637 hücrelerinin (5 µM: %55.5) canlılık oranlarında istatistiksel olarak anlamlı bir azalış tespit edilmiştir ($p<0.01$). Morfolojik analizler sonucunda her iki hücre hattında nükleer hasar ve sitoplazmada geniş vakuoller gözlemlenmiştir. Ayrıca mitokondriyal hasar ve hücre içi reaktif oksijen türleri (ROS) seviyelerinde artış görüntülenmiştir. RT-PCR analizi sonuçlarına göre 5 µM Buparlisib uygulanan RT-112 hücrelerinde *AKT* ve *mTOR* genlerinin ekspresyon düzeylerinin azaldığı belirlenmesine rağmen, 5637 hücrelerinde *AKT* (2.4-kat) ekspresyon seviyesinin anlamlı bir şekilde artış gösterdiği analiz edilmiştir ($p<0.01$).

SONUÇ: Mesane kanserinde PI3K/AKT/mTOR sinyal yolağı inhibisyonunun terapötik önemi ilk kez ortaya konmuştur. Ancak, RT-112 ve 5637 hücrelerinin Buparlisib' e yanıtında farklı ölüm tiplerinin rol alabileceği tespit edilmiştir. Bu kapsamda Buparlisib' in mesane kanserinde neden olduğu terapötik etkinin moleküler mekanizmasının aydınlatılmasına yönelik ileri çalışmaların gerçekleştirilmesi gerekmektedir.

Anahtar Kelimeler: Hücre ölümü, Mesane kanseri, PI3K/AKT/mTOR sinyal yolağı

OP-0041 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Wee1 kinaz inhibisyonunun metastatik prostat kanseri hücrelerinde moleküler ve mikroskobik düzeyde etkisinin araştırılması

Gizem Vardar[1], Hacer Ağar[2], Gamze Tiryaki[1], Gamze Güney Eskiler[2]

[1]Sakarya Üniversitesi, Sağlık Bilimleri Enstitüsü, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

[2]Sakarya Üniversitesi, Tıp Fakültesi, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

AMAÇ: Wee1 proteini, CDK1/Siklin B kompleksini inaktive ederek hücre siklusunda G2/M kontrol noktasının düzenlenmesinde rol alan bir serin-treonin kinazdır. *TP53* geni mutasyonuna sahip olan çoğu kanser tipinde Wee1'in aşırı aktivasyonu replikasyon stresi ve DNA hasarına neden olmaktadır. Bu kapsamda geliştirilen Wee1 inhibitörleri DNA hasarına sahip hücrelerin erken mitoza girmesine sağlayarak mitotik hasara ve hücre ölümüne neden olmaktadır. Bu çalışmada *TP53* mutasyonuna sahip metastatik kastrasyon dirençli prostat kanseri hücre hatlarında Wee1 inhibitörü olarak Azenosertib'in terapötik etkilerinin moleküler ve mikroskobik düzeyde incelenmesi amaçlanmıştır.

GEREÇ-YÖNTEM: DU-145 ve PC-3 metastatik kastrasyon dirençli prostat kanseri hücre hatlarının kültür koşullarında çoğaltılmasının ardından, hücrelere 1-8 nM konsantrasyon aralığında Azenosertib uygulanmıştır. Azenosertib'in DU145 ve PC-3 hücreleri üzerindeki sitotoksik etkisi CCK-8 canlılık analizi ile belirlenmiştir. Apoptotik etkisi Annexin-V analizi ve AO/PI boyaması ile değerlendirilmiştir. Ayrıca Azenosertib uygulamasına bağlı oluşabilecek hücre içi stres ile mitokondri hasarı, H2DCFDA ve mitokondri boyamalarıyla morfolojik olarak değerlendirilmiştir.

BULGULAR: CCK-8 canlılık analizi verilerine göre, her iki hücre hattında da hücre canlılığında anlamlı bir azalış tespit edilmiştir ($p<0.01$). Özellikle 6 ve 8 nM Azenosertib uygulanan PC-3 hücrelerinde canlılık oranı sırasıyla %59 ve %62 iken, DU-145 hücrelerinde %66 ve %50 olarak belirlenmiştir. Ayrıca Azenosertib'in PC-3 ve DU-145 hücrelerinde apoptotik ölüme neden olduğu tespit edilmiştir. Azenosertib'in artan dozuna bağlı olarak PC-3 ve DU-145 hücrelerinde kontrol grubuna göre intraselüler reaktif oksijen türlerinde artış ve mitokondriyal hasar görüntülenmiştir. Ancak, Azenosertib uygulanan PC-3 hücrelerinde belirgin düzeyde nükleer fragmantasyon belirlenmesine rağmen, DU-145 hücrelerinde ise çok sayıda vakuol oluşumu gözlemlenmiştir.

SONUÇ: Wee1 inhibisyonunun metastatik kastrasyon dirençli prostat kanseri hücrelerinde terapötik potansiyeli ilk kez ortaya konulmuştur. Ancak, PC-3 ve DU-145 hücrelerinin Azenosertib'e yanıtında moleküler düzeyde farklılıklar tespit edilmiştir. Bu kapsamda, hücre siklusu ve ilişkili sinyal yolaklarındaki proteinler ile hücrelerin mutasyon profillerinin üzerine detaylı moleküler analizlerin yapılmasına ihtiyaç duyulmaktadır.

Anahtar Kelimeler: Hücre siklusu, Metastatik prostat kanseri, Mitokondriyal hasar, Wee1

OP-0050 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Krosinin alfanaftiltioüre ile indüklenen akut akciğer hasarında histopatolojik ve immünohistokimyasal etkilerinin değerlendirilmesi

Mete Keçeci, Habib Khoshvaghti, Meryem Akpolat, Merve Gorgulu, Hülya Ece Kuyucu

Zonguldak Bülent Ecevit Üniversitesi, Histoloji ve Embriyoloji Anabilim Dalı, Zonguldak

GİRİŞ: Rodentisit alfanaftiltioüre (ANTU) dozbağımlı akut akciğer hasarı oluşturarak kapiler endotel bariyer kaybı, interstisyel/alveoler ödem ve inflamatuvar infiltrasyona yol açar. Güçlü antioksidan, antiinflamatuvar, antioksidan ve antiapoptotik özelliklere sahip safran karotenoidi krosin, bu tür hasara karşı koruyucu potansiyel sunar.

AMAÇ: Bu çalışma, ratlarda ANTU ile indüklenen akut akciğer hasarı modelinde krosinin histopatolojik değişiklikler, oksidanantioksidan denge, TNFα ve okludin düzeylerine etkisini incelemek amacıyla tasarlanmıştır.

GEREÇ-YÖNTEM: 32 erkek *Wistar albino* sıçan n=8 olacak şekilde çözücü kontrol grubu (1 ml zeytin yağı, 7 gün gavaj), krosin grubu (50 mg/kg, 7 gün gavaj), ANTU grubu (10 mg/kg i.p., 4 saat) ve ANTU+Krosin grubu (7 gün ANTU+Krosin) olarak dört gruba ayrılmıştır. Sakrifikasyon öncesi tartılan denekler Ketamin/ksilazin anestezisi uygulandıktan sonra feda edilmiştir. Plevral efüzyon sıvı hacimleri ölçülmüştür. Akciğer ağırlığı/vücut ağırlığı (AA/VA) ve plevral efüzyon/vücut ağırlığı (PE/VA) oranları hesaplanmıştır. Hematoksilen&Eozin boyaması ile alveoler duvar ödemi, perialveoler hemoraji ve interstisyel inflamasyon semikantitatif olarak değerlendirilmiştir. TNF-α ve okludin için immünohistokimyasal boyaması yapılmıştır. Ayrıca doku düzeyinde oksidatif stres indeksi (OSI) ve miyeloperoksidaz (MPO) düzeyleri ölçülmüştür. Boyamalar image J versiyon1.46 (NIH) ile değerlendirilmiştir. İstatistikler için One- Way ANOVA testi kullanılmıştır.

BULGULAR-SONUÇ: ANTU ve tedavi grubu arasında AA/VA ve PE/VA oranları açısından anlamlı fark bulunmamıştır. ANTU grubu, kontrolle karşılaştırıldığında anlamlı bir şekilde ödem, hemoraji, inflamasyon açısından artış göstermiştir. ANTU ve tedavi grubu arasında MPO düzeyleri açısından farklılık gözlenmezken OSI değerleri açısından tedavi grubunda ANTU grubuna göre anlamlı düşüş gözlenmiştir. TNF-α protein düzeyi ANTU+Krosin grubunda ANTU grubuna göre anlamlı bir şekilde düşmüştür ($p<0.05$). Okludin protein düzeyi ANTU+Krosin grubunda artmıştır. Krosin ön tedavisi, ANTU ile indüklenen akut akciğer hasarında koruyucu etki göstermiştir. TNF-α seviyesinin artışıyla okludin protein düzeyinin azalması ANTU grubunda kapiller geçirgenliğinin bozulduğunu gösterir. Bu bulgular, krosinin akut akciğer hasarında potansiyel terapötik ajan olarak araştırılmasını desteklemektedir.

Anahtar Kelimeler: alfanaftiltioüre, krosin, akciğer, okludin, inflamasyon, oksidatif stres

OP-0056 - Biyolojik Bilimler Ana Konuları - Embriyoloji ve Gelişim Biyolojisi

Ovaryum dokusunda pannexin 1 ekspresyonunun karakterizasyonu ve in vitro oosit maturasyonundaki rolü

Selda Kahveci[1], Derya Gökmen[2], Özgür Çınar[3]

[1]Yozgat Bozok Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Yozgat, Türkiye; Ankara Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Ankara, Türkiye

[2]Ankara Üniversitesi, Tıp Fakültesi, Biyoistatistik Anabilim Dalı, Ankara, Türkiye

[3]Ankara Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Ankara, Türkiye

Hücre-hücre iletişimi, ovaryum folikül gelişimi ve oosit olgunlaşmasında çok önemli bir rol oynamaktadır. Bu iletişimde muhtemelen Konneksin (Conx) ve Panneksin (Panx) ailelerine ait büyük gözenek oluşturan kanallar tarafından kolaylaştırılmaktadır. Panx ailesinin bir üyesi olan Panx1, folikül gelişim yetersizliği ve oosit sağkalım eksiklikleri ile ilişkilendirilmiştir (1). Bu nedenle, bu çalışmada fare ovaryumunda gelişen foliküllerin her bir bileşeninde ve in vitro maturasyon sürecindeki oositlerde Panx1'in lokalizasyonunu ve yoğunluğunu araştırmak amaçlanmıştır. Çalışma grupları: 90 adet 4-5 haftalık dişi Balb/C türü farelerden; ovaryum inceleme grubu ve oosit inceleme grubu olmak üzere 2 gruptan oluşturulmuştur. Ovaryum inceleme için (n=15) ovaryumun farklı aşamadaki folikülleri; hem folikül hücreleri hem de içerdikleri oositlerde Panx1'in lokalize olduğu bölgeler ve yoğunluğu immünfloresan yöntemle görüntülenerek hesaplanmıştır. Oosit inceleme grubu (n=75); in vitro oosit maturasyon değerlendirme için (GV, MI ve MII oositler) ve in vivo MII oositler aynı şekilde immünfloresan yöntemle işaretlenerek Panx1'in lokalize olduğu bölgeler ve yoğunluğu görüntülenerek hesaplanmıştır. Ayrıca protein ve mRNA düzeyinde Panx1 ekpresyonu in vitro GV, MI ve MII oositlerde Western Blot ve qRT-PCR ile gösterilmiştir. Çalışmamızda, ovaryum folikül hücreleri ve folikül oositlerindeki Panx1 ekspresyon yoğunluğu arasında önemli bir fark gözlenmemiştir. Bununla birlikte, Panx1 sinyal yoğunluğu kümülüssüz GV oositlerinde daha yüksekken, kümülüsle çevrili GV oositlerinde nispeten daha düşük ($p = 0.021$) bulunmuştur. İlginç bir şekilde, Panx1 sinyal yoğunluğu in vitro olgunlaşma sırasında GV aşamasından MII aşamasına önemli ölçüde azalmıştır ($p < 0,05$). Western blot analizi, in vitro ortamda GV, MI ve MII aşamasındaki oositler arasında Panx1 protein seviyelerinde önemli bir fark olmadığını göstermiştir. Bununla birlikte, Panx1 mRNA seviyeleri, oositler GV aşamasından MII aşamasına ilerledikçe önemli bir şekilde artmıştır ($p = 0.018$). Fare ovaryum dokusunda ve in vitro oositlerinde Panx1 ekspresyonunun varlığı gerek protein gerekse mRNA düzeyinde gösterilmiştir. Altta yatan mekanizmaları aydınlatmak ve Panx1 kanalı ile diğer üyelerinin olası rollerini keşfetmek için daha fazla moleküler düzeyde araştırma yapılması gerekmektedir.

Anahtar Kelimeler: Folikül hücreleri, Oosit Maturasyonu, Ovaryum, Panneksin 1

OP-0061 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

TNBS ile indüklenen deneysel kolit modelinde irisin ve NO düzenleyicilerinin anti-inflamatuvar ve antioksidan rolleri

Nur Özkeçeci[1], Özlem Tuğçe Çilingir Kaya[1], Ceyda Akdoğan[2], Edanur Koçbıyık[2], Fatma Nur Çatarmut[2], Nazlıcan Tepe[2], Nisanur Karadağ[2], Zarife Nigar Özdemir Kumral[3]

[1]Marmara Üniversitesi Tıp Fakültesi, Histoloji ve Embriyoloji AD, İstanbul, Türkiye

[2]Marmara Üniversitesi Tıp Fakültesi Dönem 3 öğrencileri

[3]Marmara Üniversitesi Tıp Fakültesi, Fizyoloji AD, İstanbul, Türkiye

GİRİŞ: İnflamatuvar bağırsak hastalıkları (İBH), gastrointestinal sistemin kronik inflamasyonu ile karakterize edilen sistemik hastalıklardır ve yalnızca bağırsak dokularını değil diğer organ sistemlerini de etkileyebilir. TNBS ile oluşturulan deneysel kolit modeli, İBH patofizyolojisini taklit ederek bu sistemik etkilerin araştırılmasına olanak tanıyan geçerli bir modeldir. Egzersizle ilişkili bir miyokin olan irisin'in inflamasyon, oksidatif stres ve organ koruyucu etkileri son yıllarda dikkat çekmektedir. Nitrik oksit (NO) düzenleyicileri de doku düzeyinde vasküler ve oksidatif yanıtları etkileyebilmektedir.

AMAÇ: TNBS ile indüklenen deneysel kolit modelinde irisin ve çeşitli NO modülatörlerinin (L-NAME, SNP) kolon, böbrek ve mesane dokularında inflamasyon ve oksidatif stres üzerine olan etkileri değerlendirilmiştir.

GEREÇ-YÖNTEM: Etik kurul onayıyla (MUHDEK-5722024.mar), her biri 28 adet olmak üzere dişi ve erkek Sprague-Dawley sıçanlar kullanılmıştır. TNBS (30 mg/ml) intrarektal yolla uygulanarak kolit modeli oluşturulmuş; hayvanlara irisin, irisin+L-NAME, irisin+SNP ve irisin+indometazin farklı doz ve uygulama yollarıyla verilmiştir. Histolojik değerlendirme için H&E ve PAS boyamaları yapılmış; MPO, MDA, GSH, NO, luminol/lucigenin kemilüminesansı, Na^+/K^+ ATPaz aktivitesi ve kasılma yanıtları incelenmiştir. Ayrıca, bağırsak-beyin-böbrek etkileşiminin nörokimyasal yönünü yansıtmak için böbrek dokusunda serotonin, dopamin ve noradrenalin düzeyleri HPLC ile analiz edilmiştir. İstatistiksel analizlerde tek yönlü ANOVA, post-hoc Tukey ve Mann–Whitney U testleri kullanılmıştır.

BULGULAR: TNBS uygulaması, kolon makroskopik hasarı, oksidatif stres parametreleri ve sistemik inflamatuvar yanıtları anlamlı düzeyde artırmıştır. Bu etkiler, özellikle irisin ve SNP kombinasyon tedavisiyle belirgin olarak düzelmiştir ($p<0,05$). Kolon ve mesane dokularında gözlenen histopatolojik hasar (epitel kaybı, ödem, inflamatuar hücre infiltrasyon) tedavi gruplarında azalmış, böbreklerde ise tübüler dejenerasyon ve glomerüler hasar gerilemiştir. HPLC sonuçları, irisin uygulamasının serotonin ve dopamin düzeylerini artırdığını, SNP kombinasyonunun ise noradrenalini azalttığını göstermiştir ($p<0,05$).

SONUÇ: Bu bulgular, irisin'in ve NO modülasyonunun, TNBS ile indüklenen kolit modelinde hem bağırsak hem de ilişkili organlardaki inflamasyon ve oksidatif stresi azaltmada etkili olduğunu göstermektedir. NO'dan bağımsız yollarla da etkili olabilen irisin, sistemik inflamatuvar süreçlerin yönetiminde potansiyel bir terapötik ajan olarak değerlendirilebilir.

Anahtar Kelimeler: kolit, tnbs, irisin

OP-0066 - Biyolojik Bilimler Ana Konuları - İmmünohistokimya ve Sitokimya

Prepuberte ve puberte döneminde Wistar albino sıçanların ovaryum dokusunda speksin ekspresyon düzeylerinin immün-altın ve immünhistokimya işaretleme ile incelenmesi

Ayşe Hande Yozgat[1], Deniz Billur[1], Berrin İmge Ergüder[2], Ahmet Uçar[3]

[1]Ankara Üniversitesi Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Ankara, Türkiye

[2]Ankara Üniversitesi Tıp Fakültesi, Tıbbi Biyokimya Anabilim Dalı, Ankara, Türkiye

[3]Sağlık Bilimleri Üniversitesi, Şişli Hamidiye Etfal SUAM, Çocuk Endokrinoloji Bilim Dalı, İstanbul, Türkiye

GİRİŞ: Speksin (SPX) vücut ağırlığı, metabolizma ve üremenin düzenlenmesinde rol oynayan bir peptittir.
AMAÇ: Prepuberte ve puberte dönemindeki dişi Wistar albino sıçanların serum ve ovaryum dokusunda immünhistokimya ve immün-altın işaretleme yöntemleri kullanılarak SPX düzeylerindeki değişimin gösterilmesidir.

GEREÇ-YÖNTEM: Prepubertal (n=10) (PND 28) ve pubertal (n=10) (PND 42) Wistar albino dişi sıçanlar, intrakardiyak kan alındıktan sonra sakrifiye edildi. Serum örneklerinde puberte ile ilişkili biyokimyasal parametreler ölçüldü. Ovaryum dokusunda SPX ekspresyonu immünhistokimya ve immün-altın işaretleme ile incelendi. Dokular rutin elektron mikroskobu takibine alındı ve CY212 araldit bloklara gömüldü. Bloklardan ultramikrotom ile 80 nm yarı ince kesitler ile uygun bölgeler belirlendikten sonra nikel gridlere alınarak Tris tamponu ile yıkanıp bloklama solüsyonu ile muamele edildi. Daha sonra SPX primer antikoru ile inkübe edilip 12nm kolloidal altın konjuge sekonder antikor ile işaretlendi. Kesitler geçirimli elektron mikroskobu (Hitachi 7800 Model) ile incelendi. Görüntülemeler EMIP dijital görüntü programı ile değerlendirildi. İstatistiksel analizlerde $p < 0.05$ anlamlı olarak kabul edildi.

BULGULAR: Puberte tayini için vajinal açıklık ve ilk östrus gözlendi ve ovaryumdaki korpus luteum histomorfolojik olarak gösterildi. Serum kisspeptin ve SPX düzeyleri pubertal grupta prepubertal gruba göre anlamlı derecede düşüktü (sırasıyla $p=0.07$ ve $p=0.029$). HOMA-ID (HOMA-Insulin Direnci) pubertal sıçanlarda prepubertal sıçanlara göre anlamlı olarak daha yüksekti ($p=0.018$). Geçirimli elektron mikroskobu incelemesinde; prepubertal dişi sıçanların ovaryum dokusunda; ovosit, zona pellusida ve granüloza hücresi gösterildi. Pubertal dişi sıçanların ovaryum dokusunda; ovosit sitoplazmasında mitokondriyon, ovosit mikrovillusları, granüloza hücresinde granülsüz endoplazma retikulumu, lipid damlacıkları ve teka hücreleri doğal görünümde izlendi. SPX immün-altın işaretlemede, folikülde SPX pozitifliği teka hücrelerinde, lipid damlacıklarında ve granüloza hücrelerinde gösterildi. SPX'in ovaryum dokusundaki immünhistokimya ekspresyon seviyesi pubertal grupta prepubertal gruba göre anlamlı derecede düşüktü ($p<0.001$).

SONUÇ: Çalışmamız geçirimli elektron mikroskobunda immun-altın işaretleme ile SPX pozitifliğinin teka hücrelerinde, lipid damlacıklarında ve granüloza hücrelerinde gösterildiği ilk çalışmadır. Puberte döneminde ovaryum dokusunda SPX ekspresyon düzeyinin serum düzeyi ile benzer şekilde azaldığı izlendi.

Anahtar Kelimeler: geçirimli elektron mikroskobu, ovaryum dokusu, puberte, speksin

OP-0080 - Mikroskopi Teknikleri Ana Konuları - Geçirimli Elektron Mikroskopisi

Geçirimli Elektron Mikroskopisinin (TEM) virüs araştırmaları,aşı ve hiperimmun antiserum geliştirme çalışmalarında kullanımı

Engin Alp Onen[1], Elif Kervancıoğlu Demirci[2]

[1]Koçak Farma İlaç ve Kimya San. A.Ş., Biyoteknoloji ve Aşı Ar-Ge, Tekirdağ

[2]İstanbul Üniversitesi, İstanbul Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, İstanbul

AMAÇ:
Bu çalışmada geçirimli elektron mikroskopisinin (TEM), viral enfeksiyonları önlemeye yönelik geliştirilen inaktif viral aşı ve hiperimmün antiserum çalışmalarında; in-vitro süspansiyonda serbest viral partikül doğrulaması ile in-vivo düzeyde viral partikül tespiti ve dokuya etkilerin değerlendirilmesinde izlenen teknik aşamalar, uygulamalar ve dikkat edilmesi gereken noktalar ele alınmıştır.

YÖNTEM:
VERO CCL-81 hücre kültüründe replike edilen SARS-CoV-2, beta propiolacton ile inaktive edilmiş virüs süspansiyonları, virüsle enfekte edilmiş fareler ve hiperimmün serum uygulanmış farelerin akciğer dokuları TEM incelemesi için farklı protokollerle hazırlandı. Süspansiyon örnekleri, dokuya göre farklı işlemlerle hazırlanarak viral partikül bütünlüğünü koruyacak şekilde optimize edildi. Örnekler bir histolog ve bir virolog tarafından TEM ile değerlendirildi. Bulgular, ışık mikroskobuyla yapılan morfolojik inceleme, bağışıklık yanıtına ve viral spike proteine yönelik immünohistokimya ve qRT-PCR sonuçlarıyla doğrulandı.

BULGULAR:
TEM ile süspansiyonlarda spike proteini korunmuş inaktive virüs partikülleri net biçimde gözlendi ve qRT-PCR ile doğrulandı. Doku kesitlerinde, 60–110 nm boyutlarında intraveziküler virüs benzeri yapılara rastlandı. Bu yapıların gözlendiği hücre tiplerinin immünohistokimyasal olarak spike protein pozitif bulunması ve doku qRT-PCR pozitifliği ve viral yük miktarının belirlenmesi, bulguların özgünlüğünü destekledi.

SONUÇ:
TEM, yalnızca yapısal görüntüleme değil, aynı zamanda biyolojik etkinin doku düzeyinde değerlendirilmesi açısından da özgün bir veri kaynağı sunar. Viral replikasyon göstergesi olan intraveziküler yapılar ile diğer hücre içi veziküllerin ayrımı için ultrastrüktürel detaylara hâkimiyet; immünohistokimya ve qRT-PCR doğrulaması gereklidir. Süspansiyon ve doku örneklerine özgü farklı hazırlık süreçleri, teknik uygulamalarda dikkat gerektirir. Bu yönüyle TEM, erken faz aşı ve hiperimmun antiserum çalışmalarında kritik bir değerlendirme aracıdır.

Anahtar Kelimeler: antiserum, aşı, in-vivo, SARS-CoV-2, TEM, qRT-PCR

OP-0086 - Mikroskopi Teknikleri Ana Konuları - Taramalı Elektron Mikroskopisi

Psoriasis Hastalarında Eritrosit Deformabilitesi

Tülay Mortaş[1], Tuba Betul Karadeniz[2]

[1]Kırıkkale Üniversitesi Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Kırıkkale, Türkiye

[2]Kırıkkale Üniversitesi Tıp Fakültesi, Deri ve Zührevi Hastalıkları Anabilim Dalı, Kırıkkale, Türkiye

GİRİŞ: Eritrosit deformabilitesindeki değişiklikler, kan akımındaki makaslama etkisi gibi çeşitli faktörlerle eritrositlerin şekil değiştirebilme yeteneklerini etkileyerek, kardiyovasküler hastalıklara sebep olabilmektedir. Sistemik inflamatuar deri hastalığı olan psoriasis hastalarında, kardiyovasküler risk endişe vericidir.

AMAÇ: Bu çalışmada, psoriasis hastalarında eritrosit morfolojisine Taramalı Elektron Mikroskobu (Scanning Electron Microscope; SEM)'nda bakarak, eritrosit deformabilitesini değerlendirdik.

GEREÇ-YÖNTEM: Çalışmamıza, 2024-2025 yıllarında Kırıkkale Üniversitesi Tıp Fakültesi Deri ve Zührevi Polikliniğine gelen, kronik hastalığı olmayan 18-79 yaşları arasında psoriasis hastası olmayan 30 kişi (Kontrol grubu 9 kadın, 21 erkek) ve 19-75 yaşları arasında psoriasis hastası olan 30 kişi (Hasta grubu 11 kadın, 19 erkek) dahil edildi. Rutin takipler için, EDTA (etilendiamintetraasetik asit)'lı tüplere alınan kan örnekleri SEM analizinde kullanıldı. Kan örnekleri, 2.5'lik gluteraldehitte tespit edildikten sonra lamel üzerinde yayma yapıldı. Altın-paladyum ile kaplandıktan sonra, SEM ile görüntü elde edildi. Deformabilitenin değerlendirmesinde eritrositlerin ekinosit ve sferosit evreleri baz alındı. Bu şekil ayırımı Howard J ve ark. [1] sınıflamasına göre tayin edildi. İstatistiksel olarak p değeri ≤ 0.05 anlamlı kabul edildi.

BULGULAR: Cinsiyet ve yaş açısından gruplar arasında istatistiksel olarak anlamlı farklılık görülmedi (Cinsiyet için p = 0.584, yaş için p = 0.228). Eritrosit morfolojisine göre, gruplardaki diskosit şekilli eritrositler karşılaştırıldığında anlamlı farklılık vardı (p = 0.001). Hasta grubunda diskosit şekilli eritrositler düşük çıktı (Şekil 1 ve şekil 2). Ekinosit ve sferosit şekilli eritrositlere baktığımızda da, gruplar arasında farklılık görüldü (p = 0.001). Kontrol grubuna göre, hasta grubundaki ekinosit sayısı yüksekti (Şekil 1 ve şekil 2).

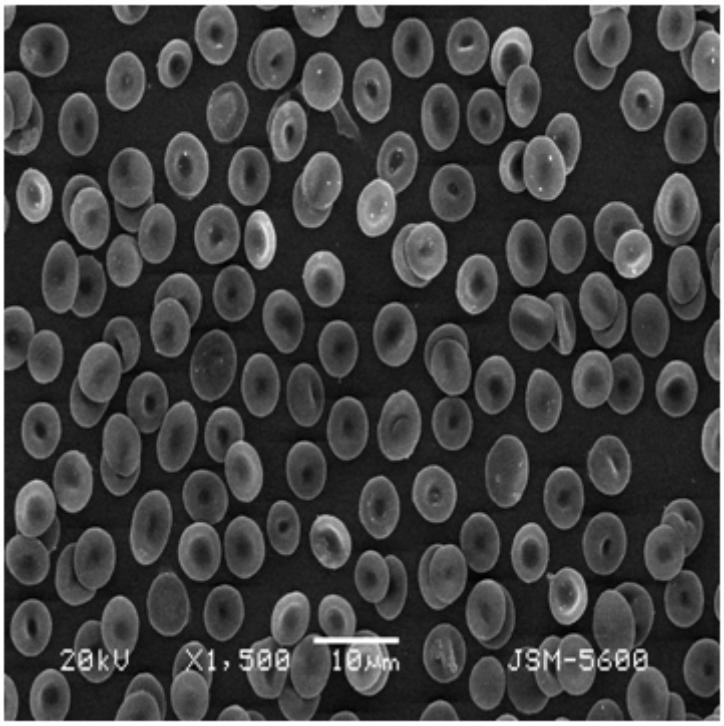
SONUÇ: Yaptığımız çalışmaya göre psoriasis hastalarındaki diskositlerin azalmasına karşın, ekinosit ve sferosit evrelerindeki eritrositlerin artış göstermesi, psoriasis hastalarında deformabilitenin azaldığını göstermektedir. Hasta sayımız göz önüne alındığında ise, sonucumuzun farklı tekniklerle yapılan çalışmalarla desteklenmesi gerekmektedir.

KAYNAKLAR

1. Khairy K, Foo J, & Howard J, Shapes of red blood cells: comparison of 3D confocal images with the bilayer-couple model. Cellular and molecular bioengineering, 1, 173-181.

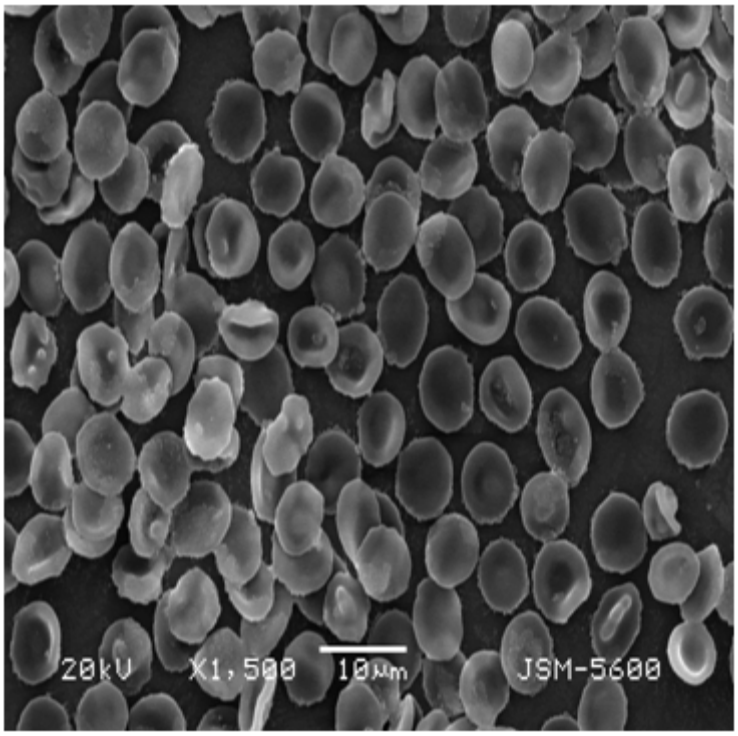
Anahtar Kelimeler: Psoriasis, Eritrosit, Deformabilite, Ekinosit, Taramalı Elektron Mikroskobu

Şekil 1



Kontrol grubunda, membran yapısı oldukça düzgün görünen diskosit şekilli eritrositler görünmektedir.

Şekil 2



Psoriasis hasta grubunda, membran yapısı dalgalı görünen ekinosit şekilli eritrositler görünmektedir.

OP-0109 - Biyolojik Bilimler Ana Konuları - Mikroorganizmalar

Karides Atıklarından Biyolojik Kitosan Üretimi ve Üretilen Kitosanın Biyolojik Uygulamalarda Değerlendirilmesi

Yosun Mater

Gebze Teknik Üniversitesi, Moleküler Biyoloji ve Genetik Bölümü, Kocaeli

Kitin deasetilasyonu süreci ile oluşturulan kitosan, serbest amin gruplarının varlığı nedeniyle sağlam ve dayanıklı yapı içeren bir poli sakkarittir. Çalışmamızda, kitin açısından zengin atık karides kabuklarından deniz izolatı bakteriler kullanılarak kitosan sentezlenmiştir. Marmara Denizi'nden izole edilen 698 bakteri arasından karides kabuğu içeren ortamda en yüksek üretim verimliliğine sahip 7 bakteri ile kitosan üretimi gerçekleştirildi. Kitosanın doğrulama testi, P-nitroasetinalid, iyodür indükleyicileri ve FT-IR analizi ile yapıldı. Bakteriler yardımıyla elde edilen kitosanın antimikrobiyal özellikleri ve hidrojel üretimi, farklı izolatlardan elde edilen kitosanlar kullanılarak değerlendirildi. Sonuçta bakteriler tarafından üretilen kitosanının yetenekleri ticari kitosan ile karşılaştırıldı. Buna göre bakteriler yardımıyla karides atıklarından elde edilen kitosanın, ticari kitosan kadar hatta bazı uygulamalarda daha etkili olduğu bulundu. Buna ek olarak, izolatlar yardımıyla sentezlenen kitosanın ve ticari kitosanın ultrastrüktürel yapıları ve oluşturulan ürünleri Taramalı Elektron Mikroskobu (SEM) kullanılarak karşılaştırıldı ve analiz edildi.

Anahtar Kelimeler: kitin, kitosan, deniz bakterileri, kitin deasetilaz, antimikrobiyal aktivite, hidrojeller

OP-0128 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Deneysel Sinir Yaralanmalarında Nöral Mobilizasyonun Etkisinin Morfolojik Olarak İncelenmesi

Öznur Gençoğlu Tekin[1], Sezin Çevik[2], Samed Özer[3], Gökçen Özgün[4], Burcu Semin Akel[1], Merve Açıkel Elmas[5]

[1]İstanbul Kültür Üniversitesi,Fizyoterapi ve Rehabilitasyon Anabilim Dalı, İstanbul, Türkiye

[2]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Sağlık Bilimleri Enstitüsü, Histoloji ve Embriyoloji Anabilim Dalı, İstanbul, Türkiye

[3]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Deney Hayvanları Uygulama ve Araştırma Merkezi, İstanbul, Türkiye

[4]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Sağlık Bilimleri Enstitüsü, Medikal Biyoteknoloji Anabilim Dalı, İstanbul, Türkiye

[5]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, İstanbul, Türkiye

AMAÇ: Periferik sinir sistemi, merkezi sinir sistemi ile çevre arasında somatik ve otonomik iletişimi sağlamaktadır. Kompresyon tipi yaralanmaların, sinir iletimini bozarak ağrı, duyu kaybı ve motor disfonksiyona neden olduğu çalışmalarda bildirilmiştir. Nöral mobilizasyonun periferik sinir yaralanmaları üzerine terapötik potansiyeli güncel çalışmalarda ön plana çıkmaktadır. Çalışmanın amacı; deneysel periferik sinir kompresyon modelinde nöral mobilizasyonun potansiyel iyileştirici etkisinin mikroskobi teknikleri kullanılarak incelenmesidir.

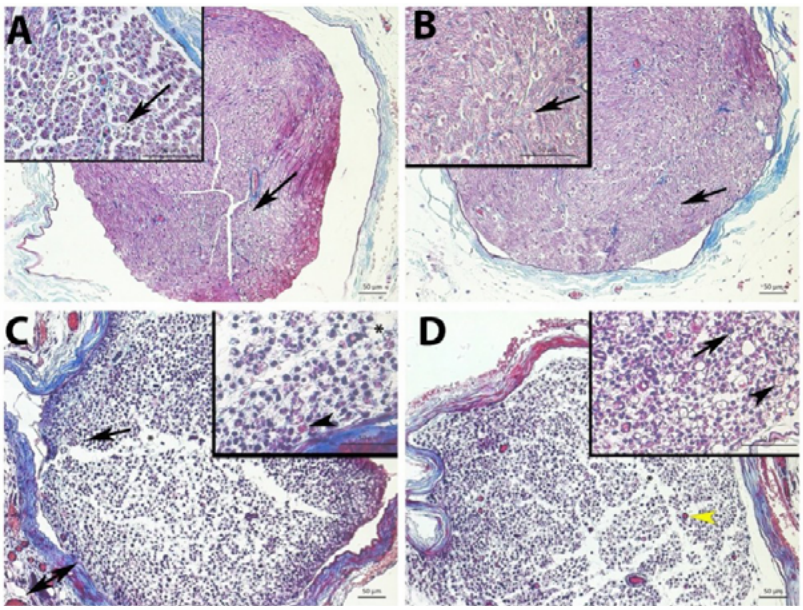
GEREÇ-YÖNTEM: Bu çalışmada, 24 adet Sprague Dawley albino sıçan; Kontrol, Sham, Nöral mobilizasyon uygulanmayan (nonNM) ve Nöral mobilizasyon (NM) uygulanan olarak 4 gruba ayrılmıştır. Kontrol grubuna herhangi bir cerrahi müdahale yapılmamıştır. Sham grubuna ise ligasyon uygulanmaksızın anestezi uygulanarak insizyon yapılmıştır. nonNM ve NM gruplarına ise siyatik sinirine ligatür yerleştirilerek anestezi altında sinir kompresyon modeli oluşturulmuştur. NM uygulamasına postoperatif 3. günde başlanarak 14 gün boyunca her gün anestezi kullanılmaksızın devam edilmiştir. Deney 14 gün sonunda anestezi altında sonlandırılmıştır. Tüm deney gruplarına ait kas ve siyatik sinir örnekleri disekte edilmiştir. Gastrokinemus kası ve siyatik sinir doku örnekleri rutin histolojik incelemeler amacıyla parafine gömülmüş, Masson'un trikrom boyası ile boyanmıştır. Sinir doku örnekleri ayrıca, geçirimli elektron mikroskobik inceleme amacıyla epoksi reçineye gömülerek yarı ince (1µm) kesitler ışık mikroskobunda, ince kesitler (80 nm) ise elektron mikroskobunda incelenmiştir.

BULGULAR: Gastrokinemus kasında Kontrol ve Sham gruplarında normal morfoloji izlenirken nonNM ve NM gruplarında yer yer kas liflerinde dejenerasyon gözlenmiştir. Siyatik sinir örneklerinde, Kontrol ve Sham gruplarında normal morfolojide çok sayıda sinir lifi izlenirken, nonNM ve NM gruplarında ise dejenere sinir lifleri izlenmiştir. Ultrastrüktürel analizlerde ise; Kontrol ve Sham gruplarının normal morfolojide çok sayıda miyelinli akson içerdiği gözlenirken, nonNM grubunda miyelinsiz akson, NM grubunda ise çok sayıda miyelinli akson izlenmiştir.

SONUÇ: Histolojik bulgular,NM'nin, sinirin distal segmentinde rejeneratif süreci destekleyebileceğini; ancak kompresyon bölgesinde bu etkinin sınırlı kaldığını ortaya koymuştur. Kas dokusunda ise NM ve nonNM grupları arasında morfolojik değişiklik izlenmemiştir. Çalışmamızda, NM'nin morfolojik açıdan rejenerasyonu desteklediği mikroskobik analizlerle gösterilmiştir.

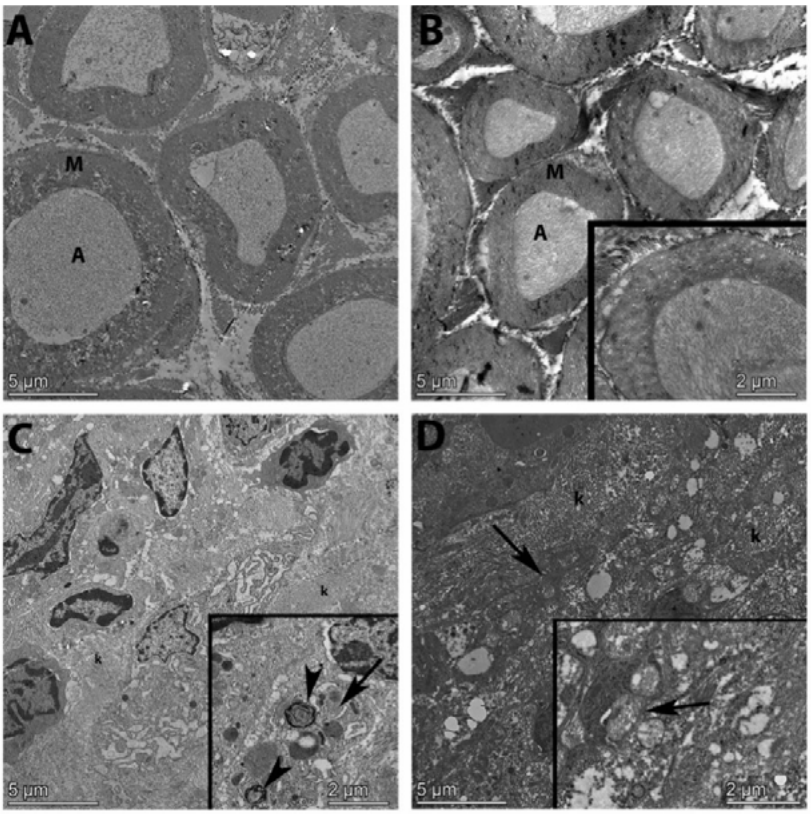
Anahtar Kelimeler: elektron mikroskobu, nöral mobilizasyon, periferik sinir yaralanması, siyatik sinir, sinir kompresyonu

Şekil-1



Deney gruplarına ait doku örneklerinde siyatik sinir morfolojisi. Kontrol grubunda normal morfolojide aksonlar (ok) izlendi (A). Sham grubunda da benzer morfolojide normal akson morfolojisi (ok) görüldü (B). nonNM grubunda epinöryumda kalınlaşma (çift taraflı ok), perinöryumda hasar (*), yer yer normal morfolojide aksonlarla (ok) birlikte çok sayıda bozulmuş morfolojide aksonlar (ok başı) izlendi (C). NM grubunda normal morfolojide aksonlar görülürken (ok), yer yer bozulmuş morfolojide (ok başı) aksonlar ve perinöryumda kan damarları (sarı ok başı) izlendi (D). (Masson Trikrom boyası, Büyütmeler: 20x, İnsetler: 40x)

Şekil-2



Deney gruplarına ait doku örneklerinde siyatik sinirin ultrastrüktürel morfolojisi. Kontrol ve Sham gruplarında çok sayıda normal morfolojide miyelinli aksonlar izlendi(A,B). nonNM grubunda hasarlı yapıda miyelinli lifler(ok başı) izlenirken yer yer çok sayıda miyelinsiz lifler (ok) gözlendi (C). NM grubunda çok sayıda miyelinsiz sinir lifleri (ok) izlendi (D). K: kollajen lifler, M: miyelin, A: Akson. (ultra ince kesitler, Uranil asetat-Kurşun sitrat)

OP-0049 - Biyolojik Bilimler Ana Konuları - Nörobiyoloji

Fulvestrantın Nesfatin-1 Nöronlarında Östrojenin Oluşturduğu Aktivasyonu Baskılayıcı Etkisinin İmmünohistokimyasal Olarak Araştırılması

Aslınur Kaya, Nergis Coşkan, Ozhan Eyigor

Bursa Uludağ Üniversitesi Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı

GİRİŞ: Östrojen üreme sistemi, metabolizma ve enerji homeostazı üzerinde önemli rol oynamaktadır. Nesfatin-1, hipotalamusta sentezlenen anoreksijenik bir nöropeptittir ve besin alımı ile enerji dengesi üzerinde etkilere sahiptir.

AMAÇ: Laboratuvarımızda yapılan önceki çalışmalarda, nesfatin-1 eksprese eden bazı nöronların östrojen reseptörleri *ERα* ve *ERβ* ile birlikte ekspresyon gösterdiği belirlenmiştir. Fulvestrant, östrojenin tam etkili antagonistidir ve östrojen reseptörlerine bağlanarak kompetitif inhibisyon gösterir. Bu çalışmada, östrojenin nesfatin-1 nöronlarında nöronal aktivasyonu başlatıp başlatmadığının ve bu etkinin fulvestrant ile baskılanıp baskılanamayacağının araştırılması amaçlanmıştır.

GEREÇ-YÖNTEM: Çalışmada overektomize Sprague-Dawley dişi sıçanlar üç gruba (n=3) ayrıldı: kontrol grubu (susam yağı), östradiol grubu (1 mg/kg 17 beta östradiol) ve antagonist grubu (1 mg/kg 17 beta östradiol + 3 mg/kg fulvestrant). Perfüzyon yöntemi ile fiksasyon uygulanan deneklerin beyin kesitlerinde nesfatin-1 ve c-Fos antikorları kullanılarak ikili immünohistokimya tekniği ile boyama gerçekleştirildi. Mikroskobik analizlerde ikili işaretlenen nesfatin-1 nöronları sayılarak bunların tüm nesfatin-1 pozitif nöronlara oranları belirlendi ve istatistiksel analizler yapıldı (Shapiro-Wilk, ANOVA/ Kruskal-Wallis; $p<0,05$ anlamlı).

BULGULAR: Hipotalamusun periventriküler çekirdeğinde yerleşik nesfatin-1 nöronlarında östrojene bağlı nöronal aktivasyonun kontrol grubuna göre anlamlı şekilde arttığı gözlendi (2,87±0,90 vs 39±9,98; p=0,02). Benzer şekilde, supraoptik çekirdekte yerleşik nesfatin-1 nöronlarında da östrojene bağlı nöronal aktivasyonun kontrol grubuna göre anlamlı şekilde arttığı gözlendi (0,16±0,08 vs 21,33±5,80; p=0,02). Antagonist grubunda, östradiol grubuna kıyasla hem supraoptik çekirdekte (21,33±5,80 vs 0,35±0,77; p=0,022) hem de periventriküler çekirdekte(39,00±9,98 vs 2,22±0,56; p = 0,013) nesfatin-1 nöronlarında gözlenen c-Fos aktivasyonunun anlamlı düzeyde azaldığı gözlendi.

SONUÇ: Çalışma bulgularımız, dışarıdan verilen östrojenin bir grup nesfatin-1 nöronunda nöronal aktivasyonu başlattığını göstermiştir. Bu bulgu, östrojenin nesfatin-1 nöronlarında eksprese edilen östrojen reseptörlerine bağlanarak bu nöronların anoreksijenik etkisini kısmen de olsa düzenleyebileceğini düşündürmektedir. Östrojen ile birlikte uygulanan fulvestrant, hem periventriküler hem de supraoptik çekirdeklerde nesfatin-1 nöronlarında gözlenen aktivasyonu azaltmış; bu durum, östrojenin etkisinin östrojen reseptör aracılı olduğu ve fulvestrant tarafından antagonize edilebildiğini düşündürmüştür.

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Anahtar Kelimeler: c-Fos, fulvestrant, hipotalamus nesfatin-1, östrojen, sıçan

POSTER BİLDİRİLER

PP-02 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Tamoksifen Yüklü Lipit Nanopartüküllerin Meme Kanseri İndüklenmiş Fareler Üzerindeki Etkilerinin İncelenmesi: Morfolojik Değerlendirme

Gizem Kosif[1], Merve Açıkel Elmas[2], Gökçen Özgün[7], Şevval Günbay[3], Samed Özer[6], Sevgi Sarıgül Özbek[5], Gülen Melike Demirbolat[4]

[1]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Sağlık Bilimleri Enstitüsü, Histoloji ve Embriyoloji Ana Bilim Dalı, İstanbul

[2]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Ana Bilim Dalı, İstanbul

[3]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Eczacılık Fakültesi, Analitik Kimya Ana Bilim Dalı, İstanbul

[4]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Eczacılık Fakültesi, Farmasötik Teknoloji Ana Bilim Dalı, İstanbul

[5]İstanbul Üniversitesi, Eczacılık Fakültesi, Analitik Kimya Ana Bilim Dalı, İstanbul

[6]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Deney Hayvanları Uygulama ve Araştırma Merkezi, İstanbul

[7]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Sağlık Bilimleri Enstitüsü, Medikal Biyoteknoloji Anabilim Dalı, İstanbul

Amaç
Meme kanseri kadınlarda en sık görülen malignitelerden biridir. Tamoksifen, FDA onaylı, meme kanserinin hormon tedavisinde kullanılan hidrofobik bir antikanser ajan ve seçici östrojen modülatörüdür. Ancak düşük suda çözünürlüğü biyoyararlanımını sınırlar. Katı lipid nanopartikülleri (SLN) ve Nanoyapılı Lipid Taşıyıcılar (NLC), biyouyumluluk ve yüksek ilaç taşıma kapasitesi gibi avantajlar sağlar. Bu çalışmada, Tamoksifen yüklü SLN ve NLC formülasyonlarının, in vivo fare meme kanseri modelinde histomorfolojik değişimlere etkisi araştırılmıştır.

Materyal ve Metot
Balb-c nude fareler, Sham, SLN, NLC, Tamoksifen yüklü SLN (SLN-TMX) ve Tamoksifen yüklü NLC (NLC-TMX) olmak üzere beş gruba ayrılmıştır (her grup n=7, toplam n=35). Tüm gruplara 1×10^6 MCF7 meme kanseri hücre hattı subkutan uygulanmış, iki hafta sonunda tümör gelişimi gözlenmiştir. Sham dışındaki gruplara formülasyonlar iki hafta boyunca üç gün ara ile verilmiştir. Deney sonunda, dokular formalinle fikse edilip parafin bloklara alınmış, histomorfolojik ve CD31 immünohistokimyasal incelemeler yapılmıştır. Ayrıca geçirimli elektron mikroskopisi için glutaraldehit fiksasyonu uygulanmıştır.

Bulgular
Histopatolojik incelemelerde tüm gruplarda tümör kaynaklı süt kanallarında epitel hücreleri saptanmış, ancak stromaya invazyon izlenmemiştir. Prolifere olan ve duktal morfolojisi bozulan hücreler CD31 pozitif bulunmuştur. Elektron mikroskopisi bulguları da morfolojik dejenerasyonu doğrulamıştır.

Sonuç
Tamoksifen yüklü SLN ve NLC formülasyonları, fare meme kanseri modelinde histomorfolojik değişikliklere neden olmuş, CD31 pozitifliği vaskülarizasyon ve proliferasyonla ilişkilendirilmiştir. Bulgular, lipid nanopartikül bazlı Tamoksifen formülasyonlarının biyoyararlanım artırıcı etkileriyle deneysel meme kanseri modellerinde umut vadettiğini göstermektedir.

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Anahtar Kelimeler: CD31, Histomorfoloji, Lipit Nanopartiküller, Meme Kanseri, Vaskülarizasyon

PP-06 - Biyolojik Bilimler Ana Konuları - Kök Hücre Biyolojisi

Menstrual kandan izole edilen kök hücrelerin metformin uygulamasına cevabı ve infertilite ile ilişkisi

Aslınur Aktaş[1], Hilal Kabadayı Ensarioğlu[2], Yıldız Uyar[3], Hafize Seda Vatansever[4]

[1]Manisa Celal Bayar Üniversitesi, Lisansüstü Eğitim Enstitüsü, Histoloji ve Embriyoloji Anabilim Dalı, Manisa, Türkiye

[2]İzmir Bakırçay Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, İzmir, Türkiye

[3]Manisa Celal Bayar Üniversitesi, Tıp Fakültesi, Kadın Hastalıkları ve Doğum Anabilim Dalı, Manisa, Türkiye

[4]Manisa Celal Bayar Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Manisa, Türkiye

GİRİŞ-AMAÇ: Kök hücreler, sınırsız çoğalma kapasitesine sahip ve farklı hücre tiplerine dönüşebilen öncü hücrelerdir; bunun yanında menstrual kan kök hücreleri (MenKH), non-invazif yolla elde edilebilmeleri ve yüksek yenilenme kapasiteleri sayesinde bu çalışmada tercih edilmiştir. İnfertil ve fertil hastalardan alınan menstrual kan örneklerinden mezenkimal kök hücre elde edilmesi, kültürü ve 30 gün metformin uygulaması sonrasında değişikliklerin immunositokimyasal analizlerle incelenmesi burada amaçlanmıştır.

GEREÇ-YÖNTEM: MenKH'ler fertil ve infertil hastaların menstrual kan örneklerinden kollajenaz-I veya ficoll protokolleriyle elde edildi. Hücrelerin kültürü sonrasında karakterizasyonu CD34, CD44, CK14 varlıklarıyla immunositokimyasal olarak değerlendirilirken; adipojenik, kondrojenik ve osteojenik farklılaşma potansiyelleri rutin protokollerle gerçekleştirildi. Fertil (grup 1) ve infertil (grup 2) MenKH'ler kontrol grupları, metformin (800 mg/gün) uygulanan fertil (grup 3) ve infertil (grup 4) örnekleri çalışma grupları olarak çalışıldı. Kültürün 30. gününde tüm grup hücreleri fikse edildikten sonra, OCT2, OCT3/4, MATE1, αVβ3 integrin, MUC1, LIF, IGF-1 dağılımları immünositokimyasal analizle değerlendirildi.

BULGULAR: Kollajenaz-I protokolüyle elde edilen MenKH'lerin kültürün 1. haftasında %85-90 konfluent olduğu, artan pasaj sayısında fibroblast benzeri özelliklerini korudukları izlendi. Hücrelerde CD44 immunoreaktivitesi pozitif, CD34 ve CK14 negatifti. Kollajenaz-I protokolüyle elde edilen MenKH'lerde, Oil Red boyası 7. günde pozitif, kondrojenik ve osteojenik boyamalar ise 14 ve 21. günlerde pozitifti; bu bulgular kollajenaz-I protokolünün ficoll protokolüne kıyasla daha uygun olduğunu gösterdi. MATE1, grup 1 ve 4'te kuvvetli, grup 2 ve 3'te orta; OCT-2, grup 1 ve 3'te orta, grup 2 ve 4'te kuvvetli; OCT3/4 sadece grup 3'te zayıf pozitif; IGF1, grup 2'de orta, grup 4'te zayıf pozitif; LIF ise grup 3 ve 4'te zayıf, diğer gruplarda negatif bulundu.

SONUÇ: Kollajenaz-I protokolüyle elde edilen hücrelerin, ficoll yöntemine kıyasla daha stabil ve morfolojik olarak daha tutarlı olması, bu yöntemin MenKH izolasyonu için daha uygun olduğunu göstermektedir. İmmunositokimya sonuçları, bu hücrelerin mezenkimal kök hücre kaynağı olarak ve infertil hasta örneklerininde in vitro çalışmalarda kullanılabilir bir model olduğunu desteklemektedir.

Anahtar Kelimeler: kollajenaz I, ficoll, mezankimal kök hücre, Menstrual kan kök hücresi, mezankimal kök hücre farklılaşması

PP-07 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Kabazitaksel ve tannik asit kombinasyonunun metastatik kastrasyon dirençli prostat kanseri hücreleri üzerindeki anti-kanser etkisi

Gökçe Kızılaslan[1], Gülsüm Reyhan Özakkaş[2], Hacer Ağar[3], Gamze Güney Eskiler[3]

[1]Sakarya Üniversitesi Tıp Fakültesi, Sakarya

[2]Sakarya Üniversitesi, Sağlık Bilimleri Enstitüsü, Tıbbi Biyoloji Bölümü, Sakarya

[3]Sakarya Üniversitesi, Tıp Fakültesi, Tıbbi Biyoloji Ana Bilim Dalı, Sakarya

AMAÇ: Taksan grubu ajanlar, mikrotübüllere bağlanarak hücre iskeleti organizasyonunu stabilize eden ve günümüzde kastrasyon dirençli metastatik prostat kanseri tedavisinde kullanılan bir kemoterapik ilaç grubudur (1). Kabazitaksel (KBZ) ikinci nesil taksan grubu ilaç olmasına rağmen, gelişen ilaç direnci ve neden olduğu ciddi yan etkiler hastalarda tedavi başarı oranını düşürmektedir. Bu nedenle, kemoterapötik ajanların doğal bileşiklerle kombin uygulamaları dikkat çekmektedir. Tannik asit (TA), yeşil üzüm ve kahve gibi bitkilerde bulunan bir tanen türevi olup kanser gelişiminde rol alan onkogenik sinyal yolaklarının baskılanmasında önemli roller almaktadır (2). Bu çalışmada, KBZ veya TA ve kombin uygulamasının metastatik kastrasyon dirençli prostat kanserinde potansiyel anti-kanser etkisinin araştırılması amaçlanmıştır.

GEREÇ-YÖNTEM: PC-3 ve DU145 prostat kanseri hücre hatlarına farklı konsantrasyonlarda KBZ (0.5 ve 1 µM) veya TA (0.5 ve 1 µM) ve kombin dozları uygulanmıştır. CCK-8 canlılık analizi ile KBZ ve TA kombinasyonunun etkin dozu belirlendikten sonra, PC-3 ve DU145 hücrelerinde neden olduğu hasar AO/PI ve mitokondri boyamalarıyla görüntülenmiştir. Ayrıca KBZ ve TA kombin uygulamasının etki düzeyi SynergyFinder ile analiz edilmiştir.

BULGULAR: PC-3 ve DU145 hücrelerinde 0.5 µM KBZ + 0.5 µM TA uygulamasında canlılık oranları sırasıyla %42 ve %44.2 iken, 0.5 µM KBZ + 1 µM TA uygulandığında sırasıyla %36.8 ve %46'ya anlamlı bir şekilde azaldığı ve tek başına KBZ veya tannik aside göre daha etkin olduğu belirlenmiştir ($p<0.01$). Ayrıca, KBZ ve tannik asidin her iki hücre hattında sinerjistik etkiye neden olduğu belirlenmiştir (CI<1). AO/PI boyamasına göre KBZ ve TA uygulanan PC-3 hücrelerinde belirgin nükleer hasar ve sitoplazmik vakuolizasyon görüntülenmesine rağmen DU-145 hücrelerinde apoptoza neden olduğu gözlemlenmiştir. Bununla birlikte her iki hücre hattında kontrol grubuna kıyasla mitokondriyal hasar tespit edilmiştir.

SONUÇ: Metastatik kastrasyon dirençli prostat kanseri hücreleri üzerinde KBZ ve TA kombin uygulamasının sinerjistik etki gösterdiği ilk kez belirlenmiştir. Ancak kombin uygulamanın PC-3 hücrelerinde neden olduğu vakuolizasyon temelli hücre ölüm tiplerinin aydınlatılmasına ihtiyaç duyulmaktadır.

Anahtar Kelimeler: Hücre Ölümü, Kabazitaksel, Kombin Etki, Metastatik Prostat Kanseri, Tannik Asit

PP-08 - Biyolojik Bilimler Ana Konuları - Hücre ve Organellerin Yapısı ve İşlevi

Dişi farelerde bisfenol-M ile oluşturulan karaciğer hasarının ultrastrüktürel yönden incelenmesi

Nazan Deniz Yön Ertuğ[1], Muhammed Canik[1], Asuman Deveci Özkan[2], Tuğba Kotil[3]

[1]Sakarya Üniversitesi, Fen Fakültesi, Biyoloji Bölümü,Zooloji ABD, Sakarya

[2]Sakarya Üniversitesi, Tıp Fakültesi, Tıbbi Biyoloji ABD,Sakarya

[3]İstanbul Üniversitesi, İstanbul Tıp Fakültesi, Histoloji-Embriyoloji ABD, İstanbul

GİRİŞ: Plastik sanayisinde kullanılan önemli birleşiklerden olan bisfenoller ile yapılan çalışmalar bu maddelerin endokrin bozucu etkilerini ortaya koymuştur. Birçok farklı yolla maruz kalınan Bisfenol-A'nın (BPA) ortaya çıkan toksik etkilerinden dolayı getirilen kısıtlamalar sonucunda alternatif BPA analoglarının kullanımına geçilmiştir. Bisfenol-M (4,4-(1,3-Phenylenediisopropylidene), BPA'nın önemli bir yapısal analoğudur. Son yıllarda BPA alternatifi olarak kullanılan,yeterli sayıda çalışma bulunmayan, BPM'nin endüstride kullanımında artış gözlenmektedir.

AMAÇ: Bu çalışmada, BPM'nin fare karaciğer dokusu üzerinde meydana getirdiği hasarın ultrastrüktürel seviyede değerlendirilmesi amaçlandı.

MATERYAL-METOD: Bu çalışmada 28 adet dişi (kontrol grubu ve 3 deney grubu) BALB/c fare (n=7) kullanıldı. Deney grubundaki farelere 2,5 mg/kg, 5 mg/kg ve 10 mg/kg konsantrasyonlarında BPM, kontrol grubuna ise %1'lik DMSO içeren serum fizyolojik 14 gün boyunca her gün intraperitonel olarak uygulandı. Deney sonunda karaciğer doku örneklerinin fiksasyonu için ilk olarak %2,5'lık gluteraldehit, sonrasında postfiksasyon için %1'lik osmium tetroksit kullanıldı. Yükselen alkol serilerinden geçirilen dokular epona gömüldü. Ardından ultramikrotom 0.5 µm'luk ince kesitler, uranil asetat ve kurşun sitrat ile kontrastlanarak geçirimli elektron mikroskop (JEOL Jem 1011) ile incelendi ve fotoğraflandırıldı.

BULGULAR: Elektron mikroskop incelemesinde kontrol grubuna ait hepatosit hücrelerinde belirgin kristalı mitokondri ve yaygın endoplazma retikulumu (ER) sisternaları ile organeller intakt yapıdaydı. Deney grubuna ait hepatosit hücrelerinde mitokondride şişme, krista kaybı, kristolizis ve membran yırtılmaları görüldü. Sitoplazmada miyelin figürler ve vakuolizasyon vardı. Özellikle 5 ve 10 mg/kg dozlarında bazı mitokondride yoğun krista kaybı ve iç membranlarda yırtılma, bazı mitokondride ise matriks kristaları belli etmeyecek kadar yoğun olarak izlendi. Sitoplazmada ribozom kaybı ve ER'de yapısal bütünlük kayıpları görüldü. Özellikle yüksek doz grubunda sitoplazmada lipit birikimi ve mitokondri-ER etkileşiminde artış görüldü.

SONUÇ: BPM maruziyeti, hepatositlerde doza bağımlı mitokondri merkezli organel hasarı ve hücresel bütünlük kaybına yol açmaktadır. Mitokondride meydana gelen yapısal değişiklikler hücre içi oksidatif stres artışı ile hücre ölümünü tetikleyebilecek patolojik süreçlerin gelişimine sebep olabilir.

Anahtar Kelimeler: Bisfenol M, Karaciğer, Toksisite, İnce Yapı

PP-09 - Biyolojik Bilimler Ana Konuları - Hücre ve Organellerin Yapısı ve İşlevi

Quarter Amonyum Hidroksit ve Doğal Fenolik Komplekslerinden Timol ve Eugenol Maruziyetinin Daphnia magna Bağırsak İnce Yapısına Etkisi: Transmisyon Elektron Mikroskobu Çalışması

Nazan Deniz Yön Ertuğ[1], Şevval Koçak[1], Sevda Bağdatlı[1], Muhammed Canik[1], Tarık Dinç[1], Cansu Akbulut[1], Gizem Gençal[1], Mustafa Zengin[2], Hayriye Genç Bilgiçli[2], Tuğba Kotil[3]

[1]Sakarya Üniversitesi, Fen Fakültesi, Biyoloji Bölümü, Zooloji ABD, Sakarya, Türkiye

[2]Sakarya Üniversitesi, Fen Fakültesi, Kimya Bölümü, Organik Kimya ABD, Sakarya, Türkiye

[3]İstanbul Üniversitesi, İstanbul Tıp Fakültesi, Histoloji-Embriyoloji ABD, İstanbul, Türkiye

GİRİŞ: Timol ((2-izopropil-5-metilfenol) ve eugeno (4-(hidroksimetil)-2-izopropil-5-metilfenol)l, kekik ve karanfilin ana bileşenlerinidir. Ancak bu bileşiklerin sucul canlılar üzerindeki hücresel ve yapısal etkilerine ilişkin veriler oldukça sınırlıdır. Tatlı su kabuklusu olan Daphnia magna, kısa yaşam döngüsü, kolay kültürlenebilirliği ve çevresel stres faktörlerine karşı gösterdiği hassasiyet nedeniyle ekotoksisite çalışmalarında model organizma olarak yaygın şekilde kullanılmaktadır.

AMAÇ: Bu çalışmada, timol ve eugenolün Daphnia magna bağırsak hücrelerinde oluşturduğu ultrastrüktürel değişimleri histolojik olarak inceleyerek, bu bileşiklerin potansiyel etkilerini ortaya koymak amaçlanmıştır.

GEREÇ-YÖNTEM: Sakarya Üniversitesi Kimya Bölümü Organik Kimya ABD tarafından sentezi yapılan Eugenol (0,22 mg/l, 0,44 mg/l, 1,11 mg/l) ve Timol'ün (0,75 mg/L, 1,5 mg/L, 3 mg/L) toksisite sınır tespit deneyleri aracılığı ile konsantrasyon aralıkları belirlendi. 24 saatlik maruziyetten sonra Daphnia örnekleri %2,5'lik glutaraldehit ile fikse edilip,ardından %1 Osmiyum Tetroksit ile post-fikse edildi. Yükselen alkol serilerinden geçirilen dokular epona gömüldü. Ultramikrotom ince kesitler, uranil asetat ve kurşun sitrat ile kontrastlanarak geçirimli elektron mikroskop (JEOL Jem 1011) ile incelendi ve fotoğraflandırıldı.

BULGULAR: Daphnia türlerinin sindirim sistemi, kitinle kaplı kaslı bir ön bağırsak, emici bir orta bağırsak, bir proktodeumdan oluşmaktadır. Kalın bir bazal laminaya oturan basit prizmatik epitelden meydana gelmektedir. Daphnia magna'nın timol ve eugenol maruziyetinde orta bağırsak hücrelerinde belirgin ultrastrüktürel değişimler izlenmiştir. Her iki bileşik etkisi ile orta bağırsak epitel hücrelerinde mitokondri deformasyonları, krista kaybı, çekirdek morfolojisinde bozulmalar, sitoplazmik yoğunlaşma ve otofajik yapıların artışı dikkat çekmiştir. Özellikle doz artışına bağlı olarak bu bulgularda belirgin bir artma gözlenmiştir.

SONUÇ: Timol ve eugenolün Daphnia magna orta bağırsak epitel hücrelerinde oluşturduğu etkiler, doza bağımlı olarak artan düzeyde mitokondri hasarı ve otofajik aktivite gibi ultrastrüktürel bozulmalarla kendini göstermiştir. Mitokondri dejenerasyonunun, timol ve eugenolün ortak etkisi olarak ortaya çıktığı gözlenmiştir. Özellikle yüksek doz uygulamalarında hücre bütünlüğünde ciddi bozulmalar ve çok lamelli yapıların ortaya çıkması, bu bileşiklerin potansiyel hücresel toksisitelerini ve ekotoksik etkilerini açıkça ortaya koymaktadır.

Anahtar Kelimeler: Daphnia magna, Timol, Eugenol, Bağırsak, Toksisite, TEM

PP-10 - Biyolojik Bilimler Ana Konuları - Kök Hücre Biyolojisi

Kemik İliği Stromal Mezenkimal Kök Hücre Salgı Ürünlerinin LPS İndüklenmesi Sonrasında Değişiklikleri

Ege Efe Atasoy[1], Hilal Kabadayı Ensarioğlu[2], Hafize Seda Vatansever[3]

[1]Manisa Celal Bayar Üniversitesi, Tıp Fakültesi, Manisa, Türkiye

[2]İzmir Bakırçay Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, İzmir, Türkiye

[3]Manisa Celal Bayar Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Manisa, Türkiye; DESAM Araştırma Enstitüsü, Yakın Doğu Üniversitesi, Lefkoşa, Kuzey Kıbrıs

GİRİŞ-AMAÇ: İnsan kemik iliği kaynaklı stromal mezenkimal kök hücreler (iKİSMKH), hematopoezi destekleyen ve doku onarımı süreçlerinde görev alan multipotent progenitör hücrelerdir. T hücreleri, B hücreleri ve makrofajlar gibi immün hücrelerin aktivitesini sitokin salınımı yoluyla düzenleme yetenekleri, onları rejeneratif tıp açısından önemli bir hedef haline getirmiştir. Gram negatif bakterilerin dış zarında bulunan lipopolisakkarit (LPS), güçlü bir proinflamatuar ajandır ve deneysel inflamasyon oluşturmak için sıklıkla kullanılır. Bu çalışmanın amacı, LPS ile uyarılan KİSKH'lerin terapötik etkinliğinde bir değişiklik olup olmadığını değerlendirmek ve bu süreçte JAK/STAT yolakları ile galektinlerin rolünü araştırmaktır.

Gereç YÖNTEM: iKİSMKH'ler uygun kültür sonrasında kontrol (LPS uygulanmayan) ve LPS uygulanan grup (200 µg/mL, 48 saat) olmak üzere iki gruba ayrıldı. Hücre canlılığı Tripan Blue yöntemiyle değerlendirildi. IL-1β, IL-4, IL-6, IL-8, IL-10, IL-18 ve STAT1 dağılımları indirekt immünositokimya yöntemiyle değerlendirildi. Galektin-1 ve Galektin-3 düzeyleri ise hücre kültür vasatlarında ELISA yöntemiyle ölçüldü.

BULGULAR: Fibroblast benzeri morfoloji sergileyen iKİSMKH'lerin LPS uygulanan grupta hücre yoğunluğunun azaldığı, ancak hücre ölüm oranının kontrol grubu ile benzer olduğu gözlendi. IL-4, IL-6, IL-18 ve STAT1 her iki grupta da kuvvetli pozitif iken, IL-8 ve IL-1β LPS grubunda orta şiddette pozitif, IL-10 ise her iki grupta da negatif olduğu saptandı. Galektin-1 düzeyleri LPS grubunda 0,46 ± 0,02 ng/mL, kontrol grubunda 0,48 ± 0,03 ng/mL iken, Galektin-3 düzeylerinin LPS grubunda 1,66 ± 0,24 ng/mL, kontrol grubunda 1,22 ± 0,12 ng/mL olduğu görüldü. Ancak galectin-1 ve galectin-3'ündeğerlerinin gruplar arasında istatistiksel olarak anlamlı değildi.

SONUÇ: LPS uygulamasının KİSMKH'lerin sitokin IL-1β ve IL-8 ekspresyonundaki azalma ile inflamatuar yanıtın yön değiştirdiğini düşündürmüştür. LPS grubunda Galektin-3 düzeyinde gözlenen artış anlamlı olmasa da, bu artış erken bir immün regülasyon yanıtını yansıtıyor olabilir. STAT1 ve IL-6'daki devamlı pozitiflik, JAK/STAT yolunun kısmen aktive olduğunu işaret eder. Bu sonuçlar, KİSMKH'lerin inflamatuar stres koşullarına karşı dayanıklılığını destekleyici olduğunu göstermektedir.

Anahtar Kelimeler: İKİSMKH, LPS, Galektin1, Galektin 3, STAT1

PP-11 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Metforminin osteosarkom hücreleri üzerindeki anti-tümöral etkilerinin in-vitro olarak incelenmesi

Nazrin Novruzzade[1], Duygu Neccar[2], Rabiya Muyir Yıldırım[2], Meral Koyutürk[2]

[1]İstanbul Üniversitesi-Cerrahpaşa Lisansüstü Eğitim Enstitüsü, Cerahpaşa Tıp Fakültesi, Histoloji ve Embriyoloji Ana Bilim Dalı, İstanbul

[2]İstanbul Üniversitesi-Cerrahpaşa, Cerahpaşa Tıp Fakültesi, Histoloji ve Embriyoloji Ana Bilim Dalı, İstanbul

Tip 2 Diabetes Mellitus tedavisinde kullanılan metformin, son yıllarda adjuvan ve neoadjuvan kemoterapi protokollerinin etkinliğini artırıcı anti-tümöral özelliğiyle öne çıkmıştır. Metforminin diyabetik hastalarda kanser oluşumunu azaltırken antikanser tedavilerin prognozunu ve etkinliğini artırdığı bildirilmiştir. Bu etkilerin farklı mekanizmalar üzerinden gerçekleştiği bildirilmiştir. Bunlardan biri de mTORC1 (mammalian target of rapamycin complex 1) sinyal yoludur.

Osteosarkom en sık görülen primer kemik kanseridir. Genelde agresif seyir izleyen osteosarkom vakalarının tedavisinde çoklu kemoterapi protokolleri uygulanmaktadır. Adjuvan kemoterapideki iyileşmelere rağmen, hastalığın nüks ve metastazları sorun oluşturmaya devam etmektedir. Bu nedenle daha etkili tedavi stratejilerinin geliştirilmesi önem taşımaktadır.

Çalışmamızda osteosarkom kaynaklı MG-63 hücreleriyle oluşturulan in-vitro deney modelinde metformin, doksorubisin ve sisplatinin etkileri incelenerek, kemoterapötik ajanlarla oluşturulan ikili ve üçlü kombinasyon gruplarında metforminin anti-tümöral tedaviye olası katkıları değerlendirilmiştir.

Metformin, doksorubisin ve sisplatin ile tekli, ikili ve üçlü kombinasyonlarda doz ve zaman tayini için hücre sayımı ve MTT analizleri gerçekleştirildi. Doz ve zaman belirleme deneyleri sonucunda, etkin dozlar metformin için 10 mM, sisplatin için 2.5 µM, doksorubisin için 1.5 µM olarak, etkin süre ise 48 saat olarak belirlendi. Osteosarkom hücre hatlarının neredeyse hepsi osteoblast hücrelerinin karakteristik özelliği olan alkalen fosfotaz (ALP) enzim aktivitesine sahiptir. Deney gruplarındaki MG-63 osteosarkom hücrelerinin anti-tümöral tedaviye yanıt olarak değişen alkalen fosfotaz (ALP) aktiviteleri ölçüldü, migrasyon yetenekleri yara iyileşme (migrasyon) analizi ile, mTORC1 seviyeleri immünositokimyasal boyama ile, ultrastrüktürel yapılardaki değişimler ise geçirimli elektron mikroskobu ile incelendi.

Metforminin tek başına ve üçlü kombinasyonda MG-63 hücre migrasyonunu anlamlı düzeyde inhibe ettiği tespit edildi. Metforminin, doksorubisin ve sisplatinle üçlü uygulandığı deney grubunda, hem ALP seviyelerinde, hem de mTORC1 seviyelerinde azalma saptandı. Ultrastrüktürel incelemede üçlü deney grubunda dejenere mitokondrilerde belirgin artış, sitoplazmik liziz alanları ve apopitotik blep yapıları izlendi.

Çalışmamız, metforminin, doksorubisin ve sisplatin ile kombine uygulanmasının MG-63 hücrelerinde in-vitro olarak anti-tümöral etkinliği artırdığını ve metformin kullanımının osteosarkom tedavisinde özellikle metastazın önlenmesi açısından klinik önemi olabileceği sonucuna varmıştır.

Anahtar Kelimeler: metformin, mTOR, osteosarkom

PP-14 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Demir eksikliği anemisinde, trombosit ince yapısının geçirimli elektron mikroskobu ile değerlendirilmesi

Maidenur Sert[1], Atakan Sağlam[2], Ayşe Hande Yozgat[2], Deniz Billur[2], Belgin Can[2], Hatice Emel Özyürek[1]

[1]Sağlık Bilimleri Üniversitesi, Ankara Eğitim ve Araştırma Hastanesi, Çocuk Sağlığı ve Hastalıkları ABD, Ankara

[2]Ankara Üniversitesi Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Ankara

Giriş
Demir eksikliği anemisi (DEA), küresel düzeyde en yaygın beslenme kaynaklı bozukluklardan biridir. Demir depolarının azalması, hemoglobin sentezinde aksamalara yol açarak karakteristik mikrositer anemi tablosunu ortaya çıkarmaktadır. Mikrositer anemiye sıklıkla trombositozun eşlik etmesi, demir eksikliğinin trombosit morfolojisi ve işlevleri üzerinde de potansiyel etkileri olabileceğini düşündürmektedir.
Trombositlerdeki granüllerin tanımlanması, hücre iskeleti bileşenleri ve morfolojik değişikliklere ilişkin ince yapı düzeyinde bilgi geçirimli elektron mikroskobu incelemesi ile sağlanır.

Amaç
Demir eksikliği anemisi olan hastalara ait trombositlerin geçirimli elektron mikroskobu ile incelenerek morfolojik farklılıklarının tanımlanması amaçlanmaktadır.

Gereç ve Yöntem
DEA için hastaların mikrositer anemisine eşlik eden transferrin satürasyonu (serum demir düzeyi düşük, serum demir bağlama kapasitesi yüksek) ve/veya ferritin düşüklüğünün olması tanı kriteri kabul edildi.
Sağlıklı kontrol ve DEA'li hastalardan alınan kan örnekleri geçirimli elektron mikroskobu inceleme protokolü için EDTA (Etilendiamin tetraasetik asit) içeren kan tüplerine alındı. Fikse edilen (%2.5 gluteraldehit, 0.1M sodyum kakodilat) kan örnekleri, santrifüj edilerek trombositten zengin plazma (PRP) elde edildi. 0.1M fosfat buffer ile yıkanıp 1 saat süreyle %1 Osmiyum tetraoksit ile post-fiksasyon işlemi uygulandı. Örnekler dereceli alkollerden geçirilip CY212 araldit bloklara gömüldü. Leica Ultracut R model ultramikrotom kullanılarak 70 nm kalınlığında alınan ince kesitler uranil asetat ve kurşun sitrat ile boyanarak Hitachi HT 7800 model geçirimli elektron mikroskobu ile incelendi.

Bulgular
DEA grubundaki olgularda yapılan hemogram testlerinde hemoglobin, hematokrit, ortalama korpusküler hacim (MCV), ortalama korpusküler hemoglobin (MCH) ve serum ferritini gibi kan değerlerinde azalmayla birlikte demir bağlama kapasitesinde artış gözlemlendi.
Trombositler üzerine yapılan geçirimli elektron mikroskobu çalışmaları sonucunda; DEA grubu, sağlıklı kontrol grubu ile karşılaştırıldığında açık kanaliküler sistemde (OCS) yapısal bozulma ve sitoplazmadaki granüllerin sayısında azalma dikkat çekti.

Sonuç
Mevcut literatürde demir eksikliği anemisinde trombosit ince yapısına ait bilgi kısıtlıdır. Elde ettiğimiz bulgular sonucunda gelecekte yapılacak olan ileri incelemeler ile demir eksikliği anemisinde oluşan trombosit işlev bozukluklarına ve/veya histopatolojilerine yönelik koruyucu ve/veya tedavi edici yaklaşımlarda ilerleme sağlanabileceği düşünülmüştür.

Anahtar Kelimeler: demir eksikliği anemisi, geçirimli elektron mikroskobu, trombosit

PP-15 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Adenogenezis sürecine elektron mikroskobiyle bakış

İrem İnanç[1], Onur Bender[2], Arzu Atalay[2], Esra Erdemli[1]

[1]Ankara Üniversitesi, Histoloji ve Embriyoloji Anabilim Dalı, Ankara

[2]Ankara Üniversitesi, Biyoteknoloji Enstitüsü, Ankara

GİRİŞ: Birçok üreme organı gelişim ve farklılaşmasını fetal dönemde tamamlamasına rağmen uterus bu süreci doğum sonrası tamamlar. Memeli uterusunda doğumda lümene bakan yüzey epiteli ve bu epiteli çevreleyen farklanmamış mezenşim yapısı vardır[1]. İnsanlarda olduğu gibi laboratuvar hayvanlarında da doğum sonrası dönemde öncelikle lümen epitelinden tomurcuklanan uterus bezlerinin oluşumu olarak nitelendirilen adenogenezis denilen süreç başlar[2] ve sonrasında bezler stroma boyunca uzanıp kıvrıntılı hal alır[3] Bu süreçte aynı zamanda mezenşim de biçimsel ve işlevsel olarak farklılaşarak stromaya ve düz kas yapılarına özelleşir. Bu farklılaşma süreci erişkinlik döneminde üreme döngüsü ve gebelik için oldukça önemlidir[4].

AMAÇ: Adenogenezis süreciyle ilgili deney hayvanlarında yapılan çalışmalar çeşitli mekanizmaların etkin olduğunu gösterse de altında yatan mekanizma tam anlamıyla aydınlatılamamıştır. Bu sebeple adenogenezis sürecinde etkin olan doğum sonrası günlerde fare uterusları toplanarak elektron mikroskobunda incelendi.

GEREÇ-YÖNTEM: Dişi Balb/c fareler doğum sonrası 5, 10 ve 15 günlerde (n=3) sakrifiye edilip uterus örnekleri elektron mikroskobunda incelemek üzere %2.5 tamponlu gluteraldehitte tespit edilip takip ve kesit işlemleri yapıldı.

BULGULAR-SONUÇ: Yarı ince kesitlere bakıldığında doğum sonrası 5.günde tek katlı prizmatik epitel ve stroma hücreleri dikkat çekdi. 10.gün itibariyle stroma hücrelerinin giderek farklandığı izlendi. 15.günde epitelden stromaya uzanan bez yapısı ve özelleşmiş stroma yapısı belirgindi. İnce kesitlere bakıldığında doğum sonrası 5.günde epitel yüzeyinde apikal yüz farklanmaları, lipid damlacıkları ve aktif hücre yapısını gösteren çekirdek belirgindi. Stroma hücreleri ise dağınık haldeydi. 10. ve 15. günlere baktığımızda apikal yüz farklanmaları, aktif çekirdek belirgin iken lipid damlacıkları ise oldukça karakteristik bir yapı göstermekteydi. Stroma hücreleri birbirine daha yakın bir organizasyon gösteriyordu. Sonuç olarak adenogenezis sürecinin fare uterusunda ince yapı düzeyinde incelenmesinde, epitel ve stromal hücreler arasındaki iletişimin, hücrelerin farklanma sürecine önemli katkıda bulunduğu ince yapı düzeyinde gösterildi.

Anahtar Kelimeler: adenogenezis, uterus, elektron mikroskobi

PP-21 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

IFIT3 Knockdown Decreases Ovarian Cancer Cell Proliferation, Migration and Invasion

Suna Karadeniz Saygılı[1], Ertan Katırcı[2]

[1]Kütahya Sağlık Bilimleri Üniversitesi

[2]Kırşehir Ahi Evran Üniversitesi

AIM:
Interferon-Induced Protein with Tetratricopeptide Repeats 3 (IFIT3) plays a dual role in innate immunity and tumor immunity, functioning as both a viral defense molecule and a regulator of tumor progression. Recent studies have highlighted the IFIT3 significance in various cancer types. Herein, we aimed to elucidate its biological role in ovarian cancer.

Material METHODS: Ovarian cancer cells were transfected with IFIT3 or control siRNA. Cell viability was assessed using the MTT assay over a 4-day period and its clonogenic potential was determined using colony formation assays. Transwell migration and invasion assays were performed to assess the migration and invasion abilities of ovarian cancer cells. Immonoflorescence staining were used to assess apoptosis (caspase-3), and cell migration (p-FAK).

RESULTS: IFIT3 knockdown significantly inhibited cell proliferation and decreased migration and invasion in OVCAR3 cells compared to control siRNA-transfected cells.

CONCLUSION: The crucial role of IFIT3 in ovarian cancer progression is highlighted. IFIT3 knockdown resulted in decreased ovarian cancer cell proliferation, migration and invasion, suggesting its potential as a therapeutic target in ovarian cancer.

Anahtar Kelimeler: IFIT3, Ovarian cancer, proliferation, invasion, migration.

PP-23 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Sıçanlarda Aşil Tendon İyileşmesinde Sambucus Nigra Dozlarının Etkinliği (Deneysel Hayvan Modeli)

Behlül Dönmez[1], Alkan Bayrak[2], Alev Kural[3], Gamze Karademir[4], Merjem Purelku[5], Mustafa Sezer[6], Önder Murat Hürmeydan[1], Gamze Tanrıverdi[4], Altuğ Duramaz[1]

[1]SBÜ Bakırköy Dr.Sadi Konuk SUAM Ortopedi ve Travmatoloji Anabilim Dalı,İstanbul

[2]İstinye Üniversite Hastanesi Medikal Park Gaziosmanpaşa,İstanbul

[3]SBÜ Bakırköy Dr.Sadi Konuk SUAM Biyokimya Anabilim Dalı,İstanbul

[4]İstanbul Üniversitesi – Cerrahpaşa, Cerrahpaşa Tıp Fakültesi,Histoloji ve Embriyoloji Anabilim Dalı,İstanbul

[5]Bahçeşehir Üniversitesi, Bahçeşehir Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı,İstanbul

[6]Arçelik Ar-Ge Çayırova Kampüsü,Kocaeli

AMAÇ:
Bu çalışmanın amacı, sıçan Aşil tendonu rüptürü modelinde yapılan primer onarım sonrası farklı dozlarda uygulanan Sambucus nigra ekstresinin tendon iyileşmesi üzerindeki histolojik, biyokimyasal ve biyomekanik etkilerini değerlendirmektir.

GEREÇ-YÖNTEM:
Toplam 48 erişkin Wistar Albino sıçan, rastgele dört gruba ayrıldı: Kontrol, Sambucus (Sam) 100, Sam 300 ve Sam 600. Genel anestezi altında, tüm sıçanlarda osteotendinöz bileşkeden Aşil tendonu cerrahi olarak kesildi. Kontrol grubunda yalnızca tenotomi ve primer onarım uygulandı. Sam 100 grubunda aynı cerrahi prosedür sonrasında haftalık 100 mg/kg dozunda Sambucus nigra ekstresi intraperitoneal (i.p.) olarak uygulandı. Sam 300 ve Sam 600 gruplarına aynı cerrahi işlem uygulandı ve sırasıyla 300 mg/kg ve 600 mg/kg/gün Sambucus nigra i.p. verildi. Toplam antioksidan durumu (TAS) analizi için 3., 7. ve 14. günlerde venöz kan örnekleri (1 cc) alındı. 21. günde her gruptan dört sıçan histolojik değerlendirme amacıyla sakrifiye edildi. 42. günde kalan sekiz sıçan her grupta eşit olarak biyomekanik ve histolojik değerlendirmelere ayrıldı.

BULGULAR:
Histolojik analizde 42. günde Sam 600 grubunda en düşük inflamasyon skorları saptandı. Tenosit ve vasküler skorlar kontrol grubuna göre anlamlı derecede farklıydı ($p<0.05$). Vaskülarizasyon ve kollajen parametrelerinde doza bağlı değişiklikler gözlendi. Biyokimyasal değerlendirmede 3. günde Sam 100 grubundaki TAS değeri, Sam 300 ve Sam 600 gruplarına göre anlamlı derecede yüksekti ($p<0.05$). 14. günde Sam 600 grubunun TAS skorları kontrol grubuna kıyasla anlamlı şekilde daha yüksekti. Biyomekanik testlerde Sam 600 grubunda maksimum gerilme (maksimum stres) değerleri, kontrol ve düşük doz gruplarına göre anlamlı derecede yüksekti ($p<0.05$).

SONUÇ: Bulgulara göre Sambucus nigra, belirli dozlarda inflamasyonu azaltarak, antioksidan aktiviteyi artırarak ve biyomekanik dayanımı geliştirerek tendon iyileşmesini destekleyebilir. Ancak, 42. günde yüksek doz grubunda gözlenen artmış kondroid metaplazi skorları, normal tendon histolojisinden sapma olabileceğine işaret etmektedir. Bu sonuçlar, Sambucus nigra'nın tendon iyileşmesi sırasında doza bağlı olarak istenmeyen hücresel farklılaşmalara neden olabileceğini göstermektedir. Klinik uygulamaya geçilmeden önce daha fazla deneysel çalışmaya ihtiyaç vardır.

Anahtar Kelimeler: Antioksidan, Aşil tendonu rüptürü,Biyomekanik test,Histopatoloji,Sambucus nigra,Tendon onarımı

PP-27 - Mikroskopi Teknikleri Ana Konuları - Numune Hazırlama Teknikleri

Doğal Kaynaklı (Haematoxylum campechianum) Alüminyum Mordantlı Hematoksilen ile Ticari Harris Hematoksileninin Karşılaştırmalı Analizi

Kubilay Göçücü, Sinem Fırat, İrem Muvafık

İstanbul Kent Üniversitesi Sağlık Hizmetleri Meslek Yüksek Okulu Patoloji Laboratuvar Teknikleri Programı

AMAÇ: *Haematoxylum campechianum* (logwood) ağacının kabuklarından elde edilen boyar çözeltinin, alüminyum mordant ile hazırlanarak histolojik boyamada kullanılabilirliğini değerlendirmek ve elde edilen çözeltinin ticari hematoksilen ile boyama özellikleri açısından karşılaştırılmasını sağlamaktır. Ayrıca laboratuvar koşullarında uygulanabilir, daha ekonomik ve erişilebilir bir hematoksilen formülasyonu geliştirilmesi hedeflenmiştir.

YÖNTEM: *Haematoxylum campechianum* kabukları, distile su ile kaynatılarak boyar maddelerin ekstraksiyonu sağlanmıştır. Ekstrakte edilen çözelti süzüldükten sonra, mordantlama amacıyla alüminyum sülfat ilave edilmiştir. Bu adım, hematoksilen moleküllerinin doku proteinlerine afinitesini artıran metal-ligand komplekslerinin oluşumunu desteklemiştir. Ardından oksidasyon ajanı olarak sodyum iyodat kullanılmış ve boyar maddenin aktif hale gelerek hematein formuna dönüşmesi sağlanmıştır. Böylece histolojik boyama için uygun bir hematoksilen çözeltisi formüle edilmiştir. Reaktifin pH değeri uygun aralığa getirilerek kullanıma hazır hale getirilmiştir. Hazırlanan bu çözeltinin boyama performansını değerlendirmek amacıyla, parafin bloklara gömülmüş ve formalinle fikse edilmiş sağlıklı kolon ve karaciğer doku kesitleri kullanılmıştır. Aynı kesitler ayrıca karşılaştırmalı olarak hem Haematoxylum campechianum kaynaklı alüminyum hematoksilen hemde ticari Harris'in hematoksileni ile boyanmıştır. Her iki grup da standart boyama protokolüne göre işleme tabi tutulmuştur. Boyama sonrası kesitlerde nükleer detayların belirginliği, kontrast düzeyi ve boyanma homojenliği mikroskobik olarak değerlendirilmiştir.

BULGULAR: *Haematoxylum campechianum* kaynaklı alüminyum hematoksilen ile boyanmış kesitlerde, nükleer detayların belirginliği ve kontrast düzeyi ticari hematoksilen ile elde edilen sonuçlara büyük ölçüde benzerlik göstermiştir. Ayrıca, doğal çözeltinin formülasyon stabilitesi ve boyanma süresi yönünden laboratuvar koşullarında uygulanabilir olduğu belirlenmiştir.

SONUÇ: *Haematoxylum campechianum* kaynaklı alüminyum hematoksilen, ticari ürünlere kıyasla benzer boyama kalitesi sunmakta olup, sürdürülebilir ve yerli kaynaklara dayalı alternatif boya geliştirme çalışmalarında umut verici bir adaydır.

Anahtar Kelimeler: Haematoxylum campechianum, Histokimya, Nükleer boyama

PP-29 - Malzeme Bilimleri Ana Konuları - Enerji ve Mikroskopi

Feldispat Katkılanmış Polipirol Kaplamanın Elektrokimyasal Sentezi ve Süperkapasitör Uygulaması

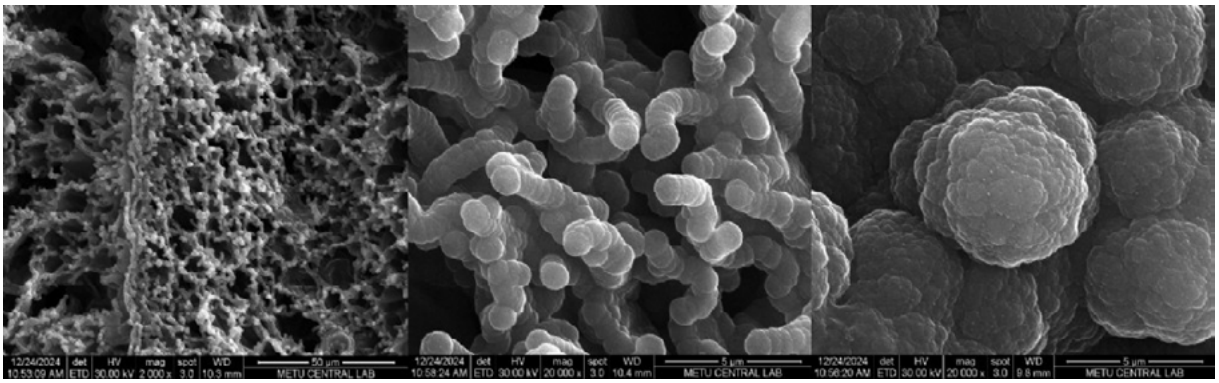
Gülsüm Sıla Küçükarslan, Nuran Özçiçek Pekmez, Erhan Karaca

Hacettepe Üniversitesi, Analitik Kimya Anabilim Dalı, Ankara

Bu proje çalışması feldispat katkılanmış polipirolün (PPy/feldispat) grafit disk elektrot yüzeyine elektrokimyasal sentezini ve Na_2SO_4 çözeltisinde elektrokimyasal davranışının incelenmesini ve süperkapasitör elektrot malzemesi olarak kullanımını içermektedir. Süperkapasitör elektrot aktif malzemesi olarak PPy/feldispat sentezlenmesi, kapasitif özelliklerinin belirlenmesi ve bir süperkapasitör hücre içinde test edilmesi bu projenin temel özgünlüğünü teşkil etmektedir. Feldispat ve pirol monomeri içeren asetonitril çözeltisinde üç elektrotlu sistemde sabit akım tekniği kullanılarak grafit disk yüzeyi PPy/feldispat filmi ile kaplanmış ve kaplamanın FESEM, XRD ve XPS ile karakterizasyonu gerçekleştirilmiştir. Kaplamanın kapasitif özelliklerini incelemek için 1 M Na_2SO_4 sulu çözeltisinde dönüşümlü voltamogramları (CVG) çeşitli tarama hızlarında kaydedilerek yük depolama mekanizması teorik olarak analiz edilmiş, psödokapasitif ve difüzyon katkıları saf polipirolünki ile karşılaştırmalı olarak sunulmuştur. Ayrıca kaplamaların elektriksel özellikleri elektrokimyasal empedans spektroskopisi (EIS) ile incelenmiştir. Çalışmanın son kısmında, PPy/feldispat kaplamış grafit kağıt anot, aktif karbon esaslı kaplanmış nikel köpük katot olarak kullanılarak, asimetrik süperkapasitör hücresi hazırlanmıştır. Ayrıca mikrosüperkapasitör anodunun hazırlanması için lazer kazıma cihazı ile poliimit bant yüzeyinde oluşturulan grafen elektroda PPy/feldispat kaplanmış ve grafen katoda karşı incelenmiştir. Elde edilen hücre dönüşümlü voltametri, galvanostatik şarj deşarj ve elektrokimyasal empedans spektroskopisi ile test edilmiştir.

Anahtar Kelimeler: superkapasitör, enerji depolama, kompozit malzemeler, iletken polimerler, elektrokimya

SEM Görüntüsü



Yapılan kaplamanın çeşitli büyütmelerde sem görüntüsü

PP-32 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Reduced Estrogen-Dependent Ovarian Cancer Proliferation by SPARSTOLONIN B: Potential Contribution of Ceramide and PI3K/Akt/mTOR Inhibition

Yagmur Dilber, Tuğçe Çeker, Aleyna Öztüzün, Mutay Aslan

Akdeniz Üniversitesi

Yağmur Dilber1, Hanife Tuğçe Çeker1, Aleyna Öztüzün1, Mutay Aslan1
1Akdeniz University, Faculty of Medicine, Department of Medical Biochemistry, ANTALYA, TURKEY

OBJECTIVE: Finding out how Sparstolonin B (SsnB) affected cell division and death in human Ovarian cancer (OVCAR-3) cell lines with and without estradiol hemihydrate (ES) was the goal of this investigation. The investigation also included measurements of phosphorylated protein kinase B alpha (p-AKT), phosphorylated mTOR (mechanistic target of rapamycin) signaling proteins, phosphoinositol-3 kinase (PI3K), and sphingomyelin/ceramide metabolites.

METHODS: The anti-proliferative effects of SsnB therapy were analyzed across various time points and concentrations. Cell proliferation was assessed by measuring Proliferating Cell Nuclear Antigen (PCNA), which was quantified using ELISA, while cell distribution was examined through immunofluorescence microscopy. Cell viability was tested using MTT analysis, and ceramide (CER), sphingosine-1-phosphate (S1P), and sphingomyelin (SM) levels were measured via LC-MS/MS. Apoptosis was evaluated using TUNEL labeling, while PI3K, p-AKT, and p-mTOR protein levels were determined through immunofluorescence staining and ELISA.

RESULTS: Administration of sparstolonin B did not produce toxicity in healthy human fibroblasts, but it dramatically reduced cell viability in ovcar-3 cells both with and without ES. S1P, PI3K, p-AKT, and p-mTOR levels were significantly lower in cancer cells treated with SsnB than in controls. Intracellular concentrations of C16-C24 CERs and apoptosis were found to significantly increase in cancer cells grown with SsnB.

CONCLUSIONS: SsnB not only reduced cell proliferation and promoted ceramide buildup and cell death but also lowered the levels of S1P, PI3K, p-AKT, and p-mTOR.

Anahtar Kelimeler: AKT, mTOR, PI3K, Sparstolonin B, Seramid

PP-33 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Deneysel 4-Nonilfenol maruziyeti sonrası sıçan plasentalarında morfolojik değişikliklerin ve interlökin 1 beta ekspresyonlarının incelenmesi

Gülçin Ulutağ[1], Cemre Nur Balcı[2], Ramazan Şimşek[1], Merve Görgülü[1], Hülya Ece Kuyucu[1], Mete Keçeci[2], Meryem Akpolat[2]

[1]Zonguldak Bülent Ecevit Üniversitesi, Sağlık Bilimleri Enstitüsü, Histoloji ve Embriyoloji Anabilim Dalı, Zonguldak

[2]Zonguldak Bülent Ecevit Üniversitesi, Tıp Fakültesi Histoloji ve Embriyoloji Anabilim Dalı, Zonguldak

GİRİŞ: 4-Nonilfenol, endüstride yaygın olarak kullanılan nonilfenol etoksilatların çevrede yıkılmasıyla oluşan sentetik bir bileşiktir. Endokrin bozucu kimyasal olarak sınıflandırılan bu madde, östrojen reseptörlerine bağlanarak östrojenik aktivite gösterir. Vücutta deri altı yağ dokusu, idrar, plasenta ve anne sütünde birikebildiği bildirilmiştir. Plasental yapı ve işlevdeki bozulmalar, fetal büyüme geriliği, preeklampsi ve gebelik kaybı gibi ciddi komplikasyonlara yol açabilir. Ancak 4-Nonilfenol maruziyetinin plasenta morfolojisi, enerji metabolizması ve inflamatuvar yanıt üzerine etkileri yeterince aydınlatılmamıştır.

AMAÇ: Bu çalışmada, 4-Nonilfenol'ün gebelikte sıçan plasentası morfolojisi ve IL-1β ekspresyonu üzerine etkilerini araştırmak amaçlanmıştır.

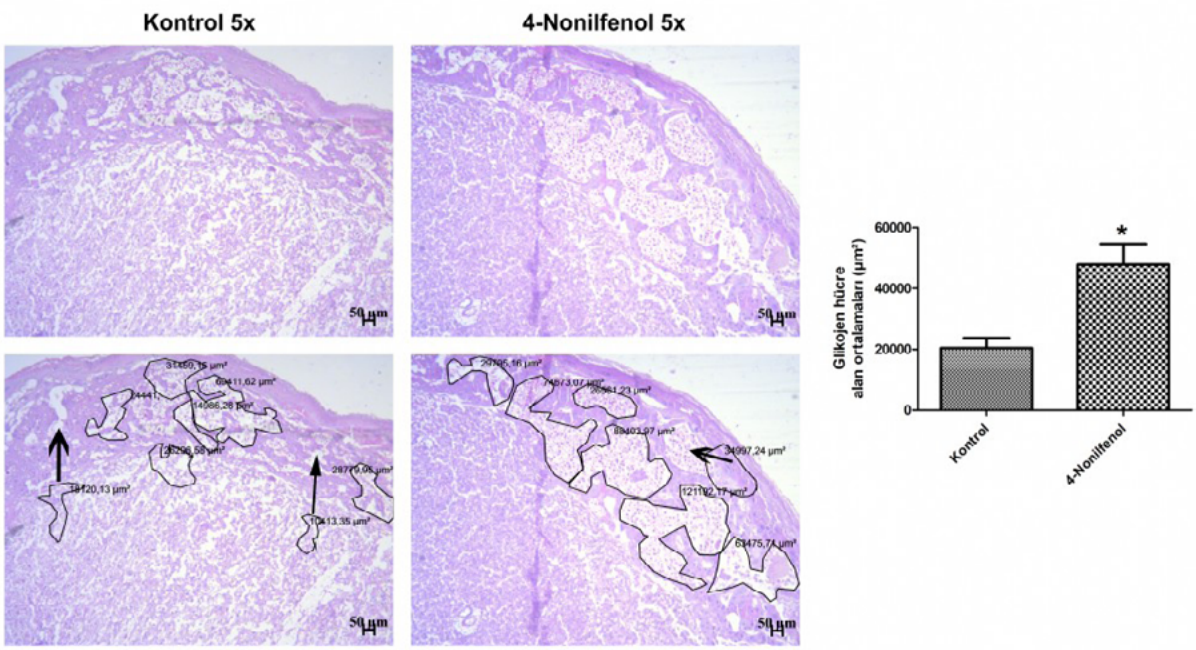
GEREÇ-YÖNTEM: 8–12 haftalık dişi sıçanlara (n=8), 40 gün boyunca intraperitoneal yolla 4-Nonilfenol (100 mg/kg/gün) mısır yağı içinde uygulanmıştır. Kontrol grubuna (n=8) yalnızca mısır yağı verilmiştir. Östrus siklusu takibi sonrası çiftleşmeye bırakılan hayvanlar, gebeliğin 19. gününde sakrifiye edilmiştir. Elde edilen plasenta dokularında Hematoksilen-Eosin ve PAS boyaları ile morfolojik inceleme yapılmış, tabaka kalınlıkları ve glikojen hücre alanları ölçülmüştür. IL-1β proteininin lokalizasyonu ve ekspresyon düzeyleri immünohistokimya yöntemiyle belirlenmiş, sonuçlar ImageJ programıyla analiz edilmiştir. Elde edilen veriler istatistiksel olarak değerlendirilmiş, gruplar arası farklar Student's t testi ve Mann–Whitney U testi ile analiz edilmiştir. $p<0.05$ değeri anlamlı kabul edilmiştir.

BULGULAR: Histolojik değerlendirmede, 4-Nonilfenol grubunda labirent tabaka kalınlığı kontrol grubuna göre anlamlı olarak azalmıştır ($p=0.0260$). Glikojen hücre kümeleri ise 4-Nonilfenol grubunda anlamlı düzeyde artmıştır ($p=0.0152$). İmmünohistokimyasal analiz sonucunda, 4-Nonilfenol uygulanan gruba ait plasenta dokularında IL-1β ekspresyonu kontrol grubuna göre istatistiksel olarak anlamlı şekilde artış göstermiştir ($p=0.005$).

SONUÇ: Labirent tabaka incelmesi, fetal-maternal madde alışverişini ve dolayısıyla embriyo gelişimini olumsuz etkileyebilir. Glikojen hücre birikimi, plasentanın enerji transfer kapasitesinde bozulma ve fetüste yetersiz beslenmeye yol açabilir. IL-1β ekspresyonundaki artış, 4-Nonilfenol'ün plasental inflamasyonu tetikleyebileceğini düşündürmektedir. Bulgularımız, 4-Nonilfenol'ün fetal gelişim ve plasental fonksiyonlar üzerinde toksik etkiler oluşturabileceğini göstermekte olup, bu etkilerin mekanizmalarını açıklığa kavuşturmak için ileri çalışmalara ihtiyaç vardır.

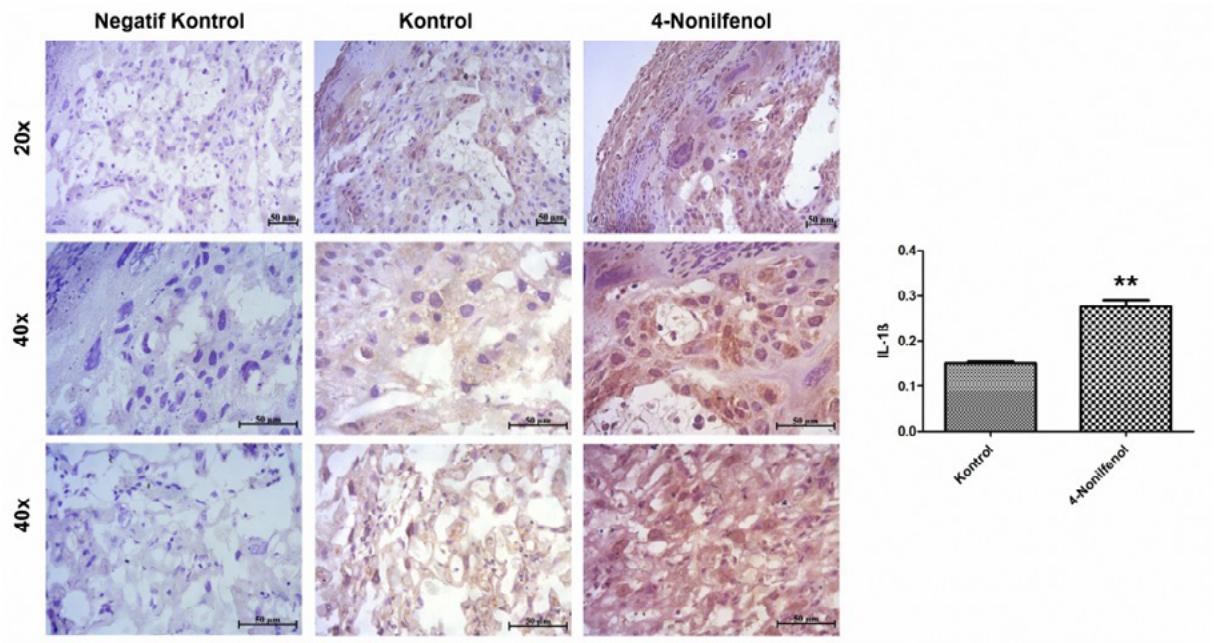
Anahtar Kelimeler: 4-Nonilfenol, Endokrin bozucu kimyasallar, İnterlökin-1β, Plasenta

Şekil 1



*Kontrol ve 4-Nonilfenol uygulanan sıçan plasentalarında PAS boyası ile gösterilen glikojen hücre kümelerinin histolojik görünümü ve kantitatif analizi. * p<0.05*

Şekil 2



*Kontrol ve 4-Nonilfenol uygulanan sıçan plasentalarında IL-1β immünohistokimyasal boyanması ve Image j analizi sonucu.** p<0.01*

PP-37 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Osimertinib dirençli akciğer kanseri hücrelerinde asit seramidaz inhibisyonu

Ecem Anadol[1], Nazlıhan Aztopal[2], Canan Vejselova Sezer[3], Oğuzhan Selvi[4], Mustafa Cengiz[5], Hatice Mehtap Kutlu[1]

[1]Eskişehir Teknik Üniversitesi, Biyoloji Bölümü, Eskişehir, Türkiye

[2]Recep Tayyip Erdoğan Üniversitesi, Biyoloji Bölümü, Rize, Türkiye; Recep Tayyip Erdoğan Üniversitesi, Biyomühendislik Bölümü, Rize, Türkiye

[3]Kütahya Dumlupınar Üniversitesi, Biyoloji Bölümü, Kütahya, Türkiye

[4]Bezmialem Vakıf Üniversitesi Hastanesi, Medikal Onkoloji Kliniği, İstanbul, Türkiye

[5]Siirt Üniversitesi, Matematik ve Fen Bilimleri Eğitimi Bölümü, Siirt, Türkiye

AMAÇ: Bu çalışmanın amacı, EGFR-TKI grubu hedefe yönelik Osimertinib kemoterapötiğine karşı dirençli hale getirilmiş H1975 küçük hücreli dışı akciğer kanseri hücrelerinde, asit seramidaz inhibitörü olan Ceranib-2'nin antikanser etkilerini araştırmaktır.

MATERYAL-METOD: Sitotoksisite düzeyi SRB testi ile kantitatif olarak ölçülmüş, morfolojik değişiklikler konfokal mikroskopi tekniği ile analiz edilmiştir. Osimertinib'e dirençli H1975 hücreleri Ceranib-2 ile 24, 48, 72 ve 96 saat süreyle inkübe edilmiştir. Belirlenen etkin konsantrasyonlarda Ceranib-2 H1975 hücrelerine uygulanmış ve acridine orange ve phalloidin boyaması sonrası çekirdek ve aktin filament yapılarının organizasyonu morfolojik değişiklikleri konfokal mikroskopta görüntülenmiştir.

BULGULAR: Ceranib-2 Osimertinib dirençli H1975 hücrelerinde konsantrasyon ve zamana bağlı sitotoksik ve antikanser etki göstermiştir. Saptanan etkin dozlar istatistiksel olarak anlamlı derecede düşük bulunmuştur. Konfokal mikroskopik analizlerde çekirdek parçalanması, kromatin kondanzasyonu, membran tomurcuklanması, aktin iskeletinde bozulmalar ve hücre şekil değişiklikleri gibi apoptoz göstergeleri saptanmıştır.

SONUÇ: Bu çalışma, Ceranib-2'nin Osimertinib dirençli H1975 hücrelerinde sitotoksik ve antikanser etkilerini ortaya koymaktadır. Bulgular, bu kanserin tedavisi için asit seramidaz inhibisyonunun, alternatif bir tedavi ajanı ve stratejisi olabileceğini düşündürmekte olup seramid metabolizmasının hedeflenmesinin dirençli akciğer kanserinde terapötik potansiyelini desteklemektedir.

Anahtar Kelimeler: akciğer kanseri, osimertinib, seramidaz inhibisyonu, sitotoksisite, apoptoz

PP-42 - Biyolojik Bilimler Ana Konuları - Botanik Alanında Mikroskopi

Taramalı Elektron Mikroskobuyla Bitkilerde Salgı Potansiyelinin Hızlı Ön Değerlendirilmesi

Pınar Akkuş Süt, Fikrettin Şahin

Yeditepe üniversitesi, Genetik ve Biyomühendislik Bölümü, İstanbul

AMAÇ: Bu çalışmanın amacı, bitki yüzey yapılarını taramalı elektron mikroskobu (SEM) ile inceleyerek; tıbbi, kozmetik ve endüstriyel açıdan değerli metabolitlerin potansiyel biyosentez kaynakları olan salgı yapılarının hızlı ve ön tarama düzeyinde belirlenebilme olanaklarını araştırmaktır. Çalışmada, salgı potansiyeli ve yapı morfolojisi iyi tanımlanmış nane (*Mentha sp.*) ve lavanta (*Lavandula sp.*) türleri ile salgı potansiyeli daha az olan zakkum (*Nerium oleander*) bitkisi karşılaştırmalı olarak değerlendirilmiş ve SEM tabanlı morfolojik incelemenin, salgı potansiyeli bilinmeyen bitkiler için etkin bir ön tarama yöntemi olarak uygulanabilirliği araştırılmıştır [1, 2].

GEREÇ-YÖNTEM: Bu çalışmada, bitkilerin yapraklarının (adaksiyal ve abaksiyal yüzeyler) ve çiçek gibi organlarının yüzeylerinden alınan örneklerdeki salgı yapıları, taramalı elektron mikroskobu (SEM) ile incelenmiştir. Görüntüleme öncesinde örnekler altın/paladyum ile kaplanarak Zeiss EVO 40 cihazında analiz edilmiştir.
BULGULAR: Yapılan SEM görüntülemeleri sonrasında nane ve lavanta bitki örneklerinde uçucu yağ sentezi ve salınımında rol aldığı bilinen yapılar yoğun olarak gözlemlenirken, zakkum yapraklarında ise bu tür yapılara rastlanmamış olup; yüzeyde daha çok tüy benzeri non-glandüler trikomların varlığı tespit edilmiştir.

SONUÇ: Bu çalışma, SEM ile görüntülemenin, bitkilerin salgı potansiyelini hızlı ve kolay bir biçimde değerlendirmede etkili bir ön tarama yöntemi olabileceğini göstermektedir. Salgı yapılarının yoğun olduğu türlerde SEM ile mevcut potansiyel rahatlıkla görselleştirilebilmekte ve bu yaklaşım ile birlikte salgı kapasitesi hakkında sınırlı bilgiye sahip bitkilerin ön değerlendirilmesi ve tür seçimi için SEM uygulanabilir bir yöntem olarak karşımıza çıkmaktadır.

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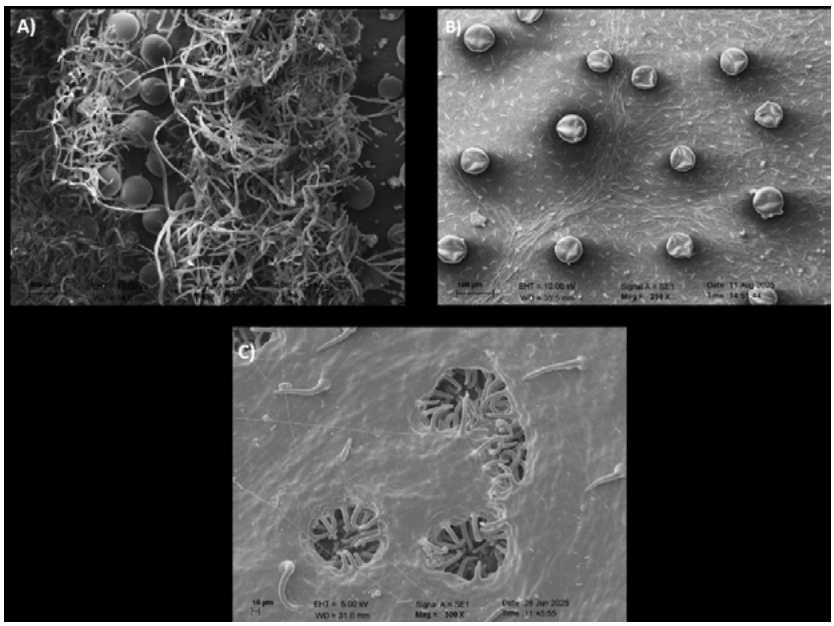
2. Zhang, Y., Wang, D., Li, H., Bai, H., Sun, M., & Shi, L. (2023). Formation mechanism of glandular trichomes involved in the synthesis and storage of terpenoids in lavender. BMC Plant Biology, 23, 307.

Anahtar Kelimeler: taramalı elektron mikroskobu, trikom, salgı yapı.

Şekil 1. Çalışmada incelenen bitkilerin SEM yüzey mikrografları:A) Lavanta Lavandula sp., B) Nane Mentha sp., C) Zakkum Nerium oleander



PP-43 - Biyolojik Bilimler Ana Konuları - Nanoteknoloji ve Uygulamaları

PEG moleküler ağırlığının PEGile edilmiş karbon kuantum noktalarının karakteristik özelliklerine etkisi

Bükem Tanören[1], Selin Tan[2], Onur Mohamed Haniffa[2], Beste Dipçin[2]

[1]Acıbadem Üniversitesi, Doğa Bilimleri Bölümü, Mühendislik ve Doğa Bilimleri Fakültesi, İstanbul

[2]Acıbadem Üniversitesi, Biyomedikal Mühendisliği Bölümü, Mühendislik ve Doğa Bilimleri Fakültesi, İstanbul

GİRİŞ: Karbon kuantum noktaları (CQD) küçük boyutları, fotostabiletileri, düşük sitotoksisiteye sahip olmaları ve uzun süreli yüksek ışık yayma özelliklerinden biyolojik sistemlerde kullanılması tercih edilen görüntüleme ajanlarıdır. CQD'lerin Polietilen Glikol (PEG) polimeri ile kaplanması (PEGilasyon), yüzey modifikasyonu sağlamakta ve biyolojik ortamlarda malzemenin stabilitesini arttırmaktadır. PEGile edilen inorganik veya organik materyallerin fiziksel ve kimyasal özelliklerinin yanı sıra sitotoksisitelerin ve hücre içi lokalizasyonunun değişkenlik gösterdiği literatürde gözlemlenmiştir. Fakat literatürde, CQD'lerin PEGilasyon işleminin, PEG'in farklı moleküler ağırlıklarına göre fiziksel ve kimyasal karakteristik özelliklerinin nasıl değiştiği bulunmamaktadır.

AMAÇ: PEG moleküler ağırlığının PEGile edilmiş CQD'lerin fiziksel ve kimyasal karakteristikleri üzerindeki etkisinin araştırılması.

YÖNTEMLER: CQD'ler sıcak balon metodu (HBBBS) ile sentezlenmiştir ve santrifüj ve diyaliz membranından (MWCO: 1kDa) geçirme ile saflaştırılmıştır. Farklı moleküler ağırlığa sahip PEG polimerleri (PEG-2, PEG-4, PEG-6, PEG-10) ile PEGilasyon kovalent olmayan şekilde gerçekleştirilmiştir. CQD'ler PEGilasyon öncesi filtreden geçirilmiş, PEGilasyon sonrası bağlanmayan CQD ve PEGler diyaliz membranı (MWCO: 10kDa) ile uzaklaştırılarak saflaştırılmıştır. Bu kapsamda CQD pegilasyonu için farklı moleküler agırlığındaki PEGler aseton veya suda 0.01M veya 0.001M olacak şekilde çözülmüş; 300, 600 ve 900 rpm lerde döndürülerek PEGilasyon işlemi yapılmıştır. Nanoparçacıkların fiziksel ve optik karakterizasyonu DLS, Zeta potansiyel ve UV-Vis spektrofotometre enstrümanları ile yapılmış, ayrıca nanoparçacıklar floresan mikroskobu ile görüntülenmiştir (385 nm).

BULGULAR: Genel olarak PEG'i asetonda çözülen örneklerinde (suda çözülen örneklere göre) yüzey yükleri ve hidrodinamik yarıçapları daha homojen olarak gözlemlenmiştir. Ayrica, 0.001M olarak çözülen (hem su hem aseton) PEGile edilen örneklerde 0.01M olarak çözülen PEGile edilen örneklere göre hidrodinamik yarıçapların daha küçük ve homojen olduğu gözlemlenmiştir.

SONUÇ: Her PEG moleküler ağırlığı için en iyi fiziksel ve optik özellikleri gösteren PEGile CQD'ler, FTIR, SEM ve TEM ile karakterize edilecektir. Bu örnekler ayrıca, biyolojik uygunluklarının değerlendirilmesi amacıyla HEK293 hücreleri üzerinde CCK-8 kiti ile sitotoksisite analizine tabi tutulacaktır ve nanoparçacıkların hücre lokalizasyonları floresan mikroskopi ile görüntülenecektir.

Anahtar Kelimeler: Karbon kuantum noktaları, PEGile edilmiş kuantum noktalar, pegilasyon

PP-47 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Sıçanlarda 4-nonilfenol maruziyetinin endometriyum üzerindeki etkilerinin histopatolojik ve immünohistokimyasal yöntemle değerlendirilmesi

Dilara Yiğit[1], Mete Keçeci[2], Ramazan Şimşek[1], Merve Gorgulu[1], Hülya Ece Kuyucu[1], Cemre Nur Balcı[2], Meryem Akpolat[2]

[1]Zonguldak Bülent Ecevit Üniversitesi, Sağlık Bilimleri Enstitüsü, Histoloji ve Embriyoloji Anabilim Dalı, Zonguldak

[2]Zonguldak Bülent Ecevit Üniversitesi, Tıp Fakültesi Histoloji ve Embriyoloji Anabilim Dalı, Zonguldak

GİRİŞ: 4-Nonilfenol(NP), endokrin bozucu etkileri olan bir ksenobiyotiktir. NP'nin üreme sistemi toksisitesiyle birlikte, gebelik endometriyumundaki histopatolojik ve inflamatuvar değişiklikler yeterince aydınlatılmamıştır.

AMAÇ: Sıçanlarda NP'nin uterus dokusunda oluşturduğu histopatolojik ve inflamatuvar değişiklikleri histolojik, histokimyasal ve immünohistokimyasal yöntemlerle incelenmesi amaçlanmıştır.

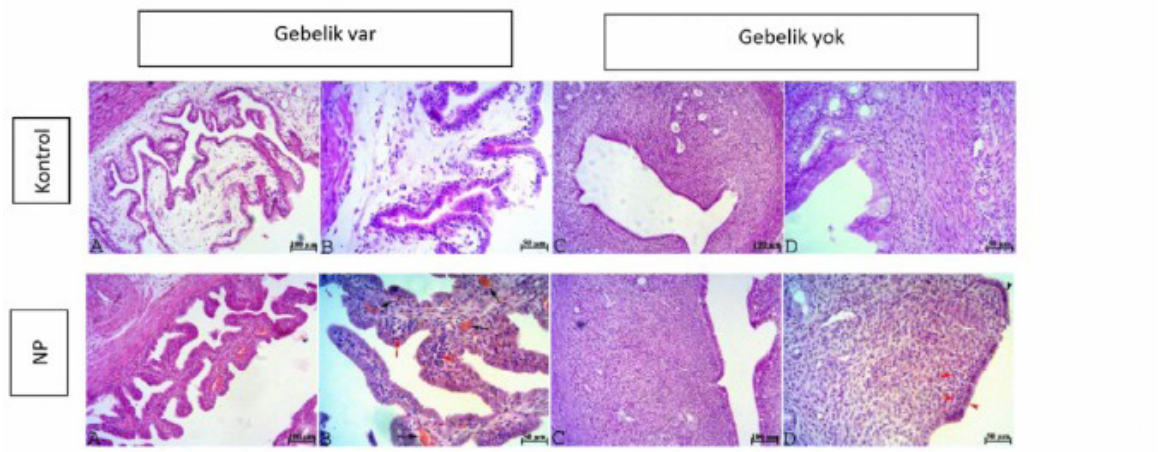
YÖNTEM: Çalışmamız, 8–12 haftalık dişi sıçanlar 4-NP(100mg/kg/gün, 40gün, mısır yağında çözülerek i.p.) verilen NP grubu(n=8) ve yalnız mısır yağı verilen kontrol(n=8) gruplarıyla oluşturulmuştur. Östrus siklusu takibi sonrası çiftleştirilen hayvanlar gebeliğin 19.gününde sakrifiye edilmiştir. Uterus dokuları Hematoksilen-Eozin, Masson trikrom(MT) ve PAS boyamalarıyla değerlendirilmiştir. TNF-α proteini için immünohistokimya yapılmış ve ImageJ ile analiz edilmiştir. Veriler istatistiksel olarak değerlendirilmiş, Mann–Whitney U ve Student's t testleriyle analiz edilmiştir($p<0,05$).

BULGULAR: H&E sonuçlarında gebe olmayan kontrol grubuna ait endometriyum yüzey epiteli, stroma ve bezlerin normal histolojide olduğu, gebe olmayan NP grubunda yüzey epitel yüksekliği azaldığı($p<0,05$) görülmüştür. Yüzey epitelinde, stromada ve bazı bez lümenlerinde başlıca eozinofiller olmak üzere inflamatuvar hücre infiltrasyonları gözlenmiştir. Gebe kontrol grubunun endometriyumlarındaki stromal hücresellik azalırken, hafif vasküler konjesyon gözlenmiştir. Hücreden fakir stroma ince kollajen lifleri içeren ödematöz görünümdeydi. Ancak gebe NP grubunda belirgin vasküler konjesyon ve yoğun eozinofilik inflamatuvar infiltrasyon görüldü. MT boyamasında, gebe NP stromasında bağ dokusu artışını; PAS boyamasında ise yüzey epitelinin glikojen içeriğinin kendi kontrollerine göre azaldığı gözlendi. Gebe olmayan NP grunuda yüzey epiteli bazal membranı seçilemedi. Np grubunda TNF-α ifadesinin azaldığı görüldü($p<0,01$).

SONUÇ: NP zayıf östrojenik etkileri olan toksik bir ajandır. Bulgularımız NP'nin östrojen reseptörlerine bağlanmak için doğal östrojenle yarıştığını ancak zayıf östrojenik etkisiyle endometriyum kalınlığı ve epitel yüksekliğinde azalmaya neden olduğunu düşündürmektedir. TNF-α ifadesinin NP gruplarındaki düşüşü, eozinofillerin başlıca IL-4, IL-5 ve IL-13 salgıladığı düşünüldüğünde, endometriyumdaki atrofik değişikliklerle TNF-α salınımı yapan hücrelerin azaldığı şeklinde yorumlanmıştır. Östrojenlerin inflamatuvar süreci baskıladığı bilinirken NP gruplarındaki inflamatuvar hücre infiltrasyonları literatürdeki gibi NP'nin toksik etkisiyle doğrudan inflamatuvar yanıtları tetikleyebileceğini düşündürmektedir. Farklı doz NP çalışmaları NP'nin östrojenik etkisiyle inflamasyonu tetikleyici etkisini aydınlatacaktır.

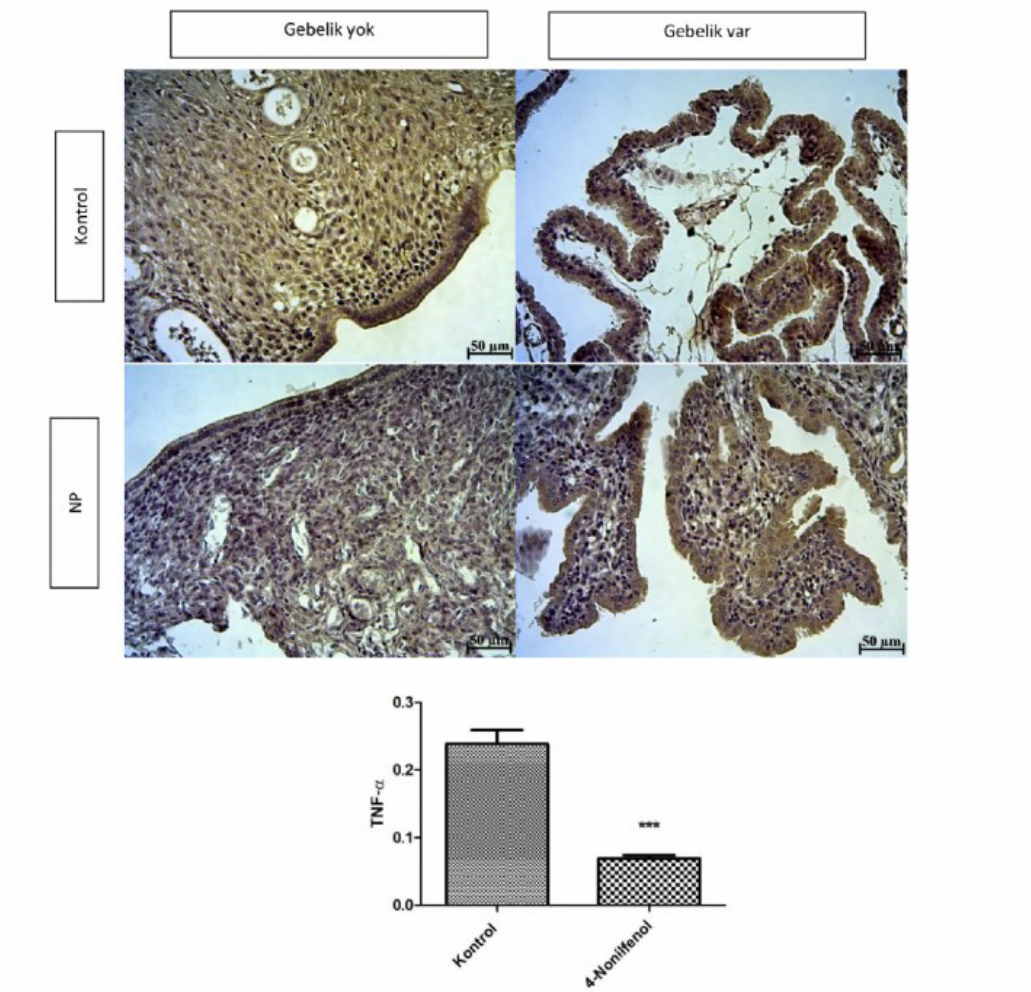
Anahtar Kelimeler: 4-Nonilfenol, Endometriyum, İnflamasyon, TNF- α, Uterus

Şekil 1



Kontrol ve NP gruplarına ait endometriyum dokularının H&E boyaması. Kırmızı ok başı; epitel hücre yüksekliğinde azalma, siyah ok başı; yüzey epitel hücrelerinde hipereozinofilik sitoplazma, kırmızı ok; inflamatuvar hücre infiltrasyonu, siyah ok; vazokonjesyon. Ölçü çubuğu: A, C: 100 µm, B, D: 50 µm.

Şekil 2



*Deneklere ait endometriyum dokularında TNF-a ifadesini göstermek için yapılan immünohistokimyasal boyaması ve Image j analizi sonucu. ***p<0.001*

PP-48 - Biyolojik Bilimler Ana Konuları - Kanser Biyolojisi

Centella asiatica ve sülforafanın T98G glioblastoma hücrelerindeki antitümör etkilerinin çok yönlü analizi

Salim Katar[1], Başak Işıldar[2], Ahmet Özdemir[1], Fatma Bahar Sunay[2], Mehmet İbrahim Tuğlu[3]

[1]Balıkesir Üniversitesi, Tıp Fakültesi, Beyin ve Sinir Cerrahisi Anabilim Dalı, Balıkesir

[2]Balıkesir Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Balıkesir

[3]Manisa Celal Bayar Üniversitesi, Tıp Fakültesi, Histoloji ve Embriyoloji Anabilim Dalı, Manisa

GİRİŞ: Glioblastoma, erişkinlerde en sık görülen agresif primer beyin tümörüdür. Hızlı büyüme, çevre dokulara infiltrasyon ve mevcut tedavilere direnç nedeniyle prognozu oldukça kötüdür. Standart tedaviye rağmen ortalama sağkalım 12–15 ayla sınırlı, 5 yıllık sağkalım ise %5'in altındadır. Bu durum, glioblastomanın biyolojik ve moleküler mekanizmalarını hedefleyen tedavi yaklaşımlarına duyulan acil ihtiyacı ortaya koymaktadır. Centella asiatica (CA), geleneksel tıpta uzun süredir kullanılan ve triterpenoid saponinler içeren tıbbi bir bitkidir. Antioksidan, antiinflamatuvar ve antikanser özellikleri bilinmekte olup, özellikle proliferasyonu ve migrasyonu baskılayıcı, apoptozu uyarıcı etkileriyle öne çıkmaktadır. Sülforafan (SFN) ise brokoli ve diğer turpgillerde bulunan doğal bir izotiyosiyanattır. Faz II detoksifikasyon enzimlerini aktive etmesi, oksidatif stres ve epigenetik mekanizmaları düzenleyici özellikleriyle tümör baskılayıcı potansiyel taşır. Ayrıca PI3K/Akt/mTOR gibi onkojenik yolları baskılayarak proliferasyonu azaltıp otofajiyi uyardığı bildirilmektedir. Düşük toksisiteleri ve çoklu hedeflere etki edebilmeleri nedeniyle, her iki bileşik de glioblastoma gibi tedaviye dirençli tümörlerde alternatif veya tamamlayıcı stratejiler için umut verici adaylardır.

AMAÇ: CA ve SFN'nin olası antitümör etkilerinin çok yönlü araştırılması amaçlanmıştır.

GEREÇ-YÖNTEM: Doz optimizasyonun ardından hücrelere CA, SFN ve kombinasyonları uygulanmış; proliferasyon, migrasyon ve klonojenik potansiyel değerlendirilmiştir. Ayrıca apoptoz, otofaji ve sinyal yolakları (p-Akt/p-mTOR) immünositokimyasal olarak analiz edilmiş; metabolik ve oksidatif değişiklikleri değerlendirmek üzere laktat düzeyleri ve total oksidan durum (TOS) ölçülmüştür.

BULGULAR: CA ve SFN kombinasyonu (Kombo A: 10 µM SFN + 50 µg/mL CA) hücre canlılığını anlamlı biçimde azaltmış ve sinerjetik sitotoksik etki göstermiştir (kombinasyon indeksi<1). Kombinasyon uygulaması migrasyonu baskılamış ve koloni oluşturma kapasitesini belirgin şekilde düşürmüştür. İmmünositokimyasal analizlerde p-mTOR ekspresyonunun anlamlı düzeyde azaldığı ve mTOR yolunun baskılandığını görülmüştür. Otofaji özellikle SFN grubunda artış göstermiş, apoptoz düzeyleri artış eğilimlerine karşın istatistiksel olarak anlamlı bulunmamıştır. Metabolik açıdan, kombinasyon grubunda laktat düzeyi hafifçe azalmış, TOS düzeyinde ise anlamlı bir değişiklik gözlenmemiştir.

SONUÇ: CA ve SFN, T98G glioblastoma hücrelerinde mTOR sinyal yolunu baskılayarak proliferasyonu azaltmış, migrasyonu engellemiş ve klonojenik büyümeyi sınırlamıştır.

Anahtar Kelimeler: Centella asiatica, Glioblastoma, mTOR, Sülforafan, T98G

PP-56 - Biyolojik Bilimler Ana Konuları - Dokular ve Sistemler

Monosodyum glutamat ile indüklenen obezite modelinde karaciğer hasarına karşı aposinin morfolojik iyileştirici etkisinin değerlendirilmesi

Melis Ecem Turan[1], Hüsna Karabulut[2], Samed Özer[3], Serap Arbak[4], Merve Açıkel Elmas[4]

[1]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Sağlık Bilimleri Enstitüsü Histoloji ve Embriyoloji Anabilim Dalı, İstanbul

[2]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Moleküler Biyoloji Ve Genetik Bölümü Dönem 4 Öğrencisi, İstanbul

[3]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Deneysel Hayvan Uygulama ve Araştırma Merkezi, İstanbul

[4]Acıbadem Mehmet Ali Aydınlar Üniversitesi, Histoloji ve Embriyoloji Anabilim Dalı, İstanbul

AMAÇ: Monosodyum glutamat (MSG), yaygın olarak kullanılan bir lezzet arttırıcıdır ve Amerikan Gıda ve İlaç Dairesi (U.S. Food and Drug Administration-FDA) tarafından güvenli olarak kabul edilmesine rağmen, olumsuz reaksiyonlarla ilişkilendirilmiştir. MSG'nin karaciğer dokusunda reaktif oksijen türleri ve lipit peroksidasyonunu artırarak hücresel hasara yol açtığı bildirilmiştir. Çalışmalarda, bu durumun hepatositlerde vakuol oluşumuna, glikojen kaybına, lökosit infiltrasyonuna, fibroza ve karaciğer dokusunda artmış apoptoza neden olduğu gösterilmiştir. Aposinin, doğal bir NADPH-oksidaz inhibitörüdür ve çeşitli çalışmalarda oksidatif stresi azaltma potansiyeline sahip olduğu gösterilmiştir. Bu çalışmanın amacı, MSG ile oluşturulan obezite kaynaklı karaciğer doku hasarına karşı aposininin olası iyileştirici etkisinin mikroskobik yöntemlerle gösterilmesidir.

MATERYAL-METOD: Bu çalışmada C57BL/6J cinsi fareler dört gruba ayrılmıştır: Kontrol, MSG, MSG+DMSO ve MSG+APO. MSG grubuna postnatal 1., 2., 4., 6., 8. ve 10. günlerde deri altına MSG (2 mg/g), kontrol grubuna ise aynı günlerde serum fizyolojik uygulanmıştır. Hayvanlar 15 hafta izlendikten sonra MSG+DMSO grubuna %10'luk DMSO (10 mg/kg), MSG+APO grubuna ise aposinin (10 mg/kg) intraperitonal olarak verilmiştir. Diseksiyon sonrası alınan karaciğer dokuları parafine gömülmüş; kesitlere Hematoksilen-Eosin, Pikrosirius kırmızısı, PAS ve Masson'un Trikrom boyaları ile incelenmiştir. Kan örneklerine ise MDA ve GSH değerleri ELISA yöntemi ile incelenmiştir.

BULGULAR: Kontrol ve DMSO gruplarında morfolojik parametreler normal olarak izlenmiştir. MSG grubunda, hepatositlerde hasar, sinüzoidal alanda dilatasyon ve parankimada yer yer lökosit infiltrasyonu, bağ dokusunda artış, glikokojen dağılımında düşüş izlenmiştir. MSG ve MSG+DMSO gruplarında, MDA seviyesi yüksek iken, GSH değerinin düşük olduğu izlenmiştir. MSG+APO grubunda ise tüm bu parametrelerde iyileşme gözlenmiştir. Bu çalışmada, MSG ile indüklenen obeziteye bağlı deneysel karaciğer hasarında, aposininin oksidatif hasarı azaltarak karaciğer doku morfolojisini iyileştirdiği ve böylece tedavi edici bir ajan olarak olumlu etkiler sağladığı ortaya konmuştur.

SONUÇ: MSG ile indüklenen obeziteye bağlı deneysel karaciğer hasarında, aposininin oksidatif hasarı azaltarak karaciğer doku morfolojisini iyileştirdiği ve böylece tedavi edici bir ajan olarak olumlu etkiler sağladığı ortaya konmuştur.

Anahtar Kelimeler: Monosodyum glutamat (MSG), Aposinin, Karaciğer, ELISA

EMK 2025 ve MSC 2025
Bütünleşik Bilimsel Program
Malzeme Bilimi ve Cihazlar (MB ve C)

EMK 2025 & MSC 2025
Combined Scientific Programme
Materials Science & Instrumentation
(MS and I)

SEPTEMBER 25, 2025

08:30-17:00	**REGISTRATION**
09:00-14:00	**MICROSCOPY SCHOOL**
14:00-14:45	**OPENING CEREMONY - Conference Hall** **Opening and Welcoming** **Moment of Silence** **National Anthem** **Prof. Dr. Serap Arbak,** Chair-MSC 2025 and EMK 2025 / President- Turkish Society for Electron Microscopy **Prof. Dr. Güldal Süyen,** Vice Rector- Acıbadem Mehmet Ali Aydinlar University **Music Performance,** Gizem Kosif (Piano) & Can Gözüm (Saxophone) **Tango Dance Performance,** Melis Aydın & Barış Karahasan
14:45-15:30	**KEYNOTE LECTURE - Conference Hall** Chairs: **Serap Arbak, Servet Turan**
	Vladislav Krzyzanek - President of the European Microscopy Society Unlocking the Power of SEM: Quantitative Imaging and 4D Diffraction Across Disciplines
15:30-16:00	**COFFEE BREAK**
16:00-16:40	**PLENARY LECTURE 1 - Conference Hall** Chairs: **Melek Öztürk, Deniz Yücel**
	Ali Ertürk AI-Powered 3D Cell-Level Imaging for Disease Studies and Therapeutic Development
18:45	**WELCOME RECEPTION (Aplus Cafeteria)**

SEPTEMBER 26, 2025

09:00-18:00	**REGISTRATION**
09:00-09:40	**PLENARY LECTURE 2 - Conference Hall** Chairs: **Güldal Süyen, Merve Elmas**
	Emre Yakşi The Role of Astroglia in the Generation and Prevention of Seizures
09:40-10:10	**COFFEE BREAK**
	MS and I: Session 1 - A102 Hall Chairs: **Servet Turan, Hasan Demirci**
10:10-10:40	**Doğan Özkaya (Invited)** Catalyst Characterisation at the Cutting Edge
10:40-11:10	**Recep Zan (Invited)** Graphene-Engineered Interfaces in Cu_2SnS_3 Thin Films: Microstructural Advancements and Photovoltaic Performance
11:10-11:40	**Erçin Ç. Duran (Invited)** Sharper Eyes, Deeper Insights: Advances in TEM Electron Diffraction for Nanoscale Crystallography
11:40-12:10	**Volkan Erkut (Invited)** Life Sciences Applications on FIB-SEM
12:10-13:30	**POSTER SESSION**
13:30-14:30	**LUNCH**
	MB ve C & MS and I: Session 2 - A102 Hall Chairs: **Doğan Özkaya, Kemal Davut**
14:30-15:00	**Mustafa Güler (Davetli Konuşmacı)** FIB ile Nano Ölçekli İşlemler ve İleri Seviye Uygulamalar
15:00-15:30	**B. Tuğba Çamiç (Davetli Konuşmacı)** Yumuşak Malzemelerden Sert Malzemelere İleri Düzey Odaklanmış İyon Demeti (FIB) Uygulamaları
15:30-16:00	***Meltem Sezen Özkoç (Invited)** Hydra Bio Plasma-FIB Technologies for Multidisciplinary Research
16:00-16:30	***David Westmoreland (Invited)** Cryogenic TEM Sample Holder and MEMS-Chips Development for in Situ Cooling, Heating and Biasing Applications

** The lectures indicated are to be held in the Conference Hall*

SEPTEMBER 26, 2025

16:30-17:00	**COFFEE BREAK**
	MB ve C & MS and I: Session 3 - A102 Hall Chairs: **Recep Zan, Erçin Ç. Duran**
17:00-17:30	**Hasan Demirci (Davetli Konuşmacı)** Makro- ve Supra-Biomoleküllerin Zaman Çözünürlüklü Yapısal Kriyo Electron Mikroskopi Çalışmaları
17:30-18:00	**Kemal Davut (Davetli Konuşmacı)** Eklemeli İmalatla Üretilen Metalik Malzemelerin EBSD Tekniği ve TEM Kullanılarak Mikroyapı ve Kristalografik Dokusunun İncelenmesi
18:00-18:15	**OP-0091** **Bülent Alkan** Microstructural Characterization and Micropillar Fabrication of Austenitic Stainless Steel for Further Microscale Compression Studies
18:15-18:30	**OP-0112** **Nermin Demirkol** Assessment of the Effects of İzmit Gulf Sediment on the Microstructural and Technical Characteristics of Porcelain Tiles
18:30-18:45	**OP-0085** **Birsen Şahin** Correlating Grain Size Control in FAPbI3 Perovskite Solar Cells with Device Quality: Insights from High-Resolution Electron Microscopy
20:00	**GALA YEMEĞİ**

SEPTEMBER 27, 2025

09:00-18:00	**REGISTRATION**
09:00-09:40	**PLENARY LECTURE 3 - Conference Hall** Chairs: **Feray Bakan Mısırlıoğlu, Mehtap Kutlu**
	Aydoğan Özcan AI-Based Advances in Biomedical Microscopy and Pathology
09:40-10:00	**COFFEE BREAK**
	MB ve C: Session 4 - A102 Hall **Ülkemizdeki Eşsiz Mikroskopi Olanakları** **(Unique Microscopy Facilities in Turkey)** Chairs: **Serap Arbak, Melek Öztürk, Pınar Kaya**
10:00-10:30	**Servet Turan (Davetli Konuşmacı)** Türkiye Mikroskopi Envanteri ve Mikroskopi Yol Haritası Önerileri
10:30-11:00	**Uğur Ünal (Davetli Konuşmacı)** Elektron Mikroskobu ile İleri Malzeme ve in-situ Karakterizasyon Yöntemleri
11:00-11:30	**Selçuk Birdoğan (Davetli Konuşmacı)** Atomların Arasında: TEM ile Nano ve Piko Dünyanın İzinde
11:30-12:00	**Umut Savacı (Davetli Konuşmacı)** TEM ile Geleneksel Mikroyapı İncelemelerini Devinimli Elektron Kırınımı ve In-Situ Deneyler ile Geliştirme
12:00-12:30	***Felice D'Alia - Ass. General Manager within JEOL (EUROPE) SAS. (Invited)** Total Solution For Air/Beam Sensitive Samples ** The lecture indicated is to be held in D102 Hall*
12:30-13:30	**LUNCH**
	MB ve C: Session 5 - A102 Hall Chairs: **Uğur Ünal, Umut Savacı**
13:30-14:00	**Pınar Kaya (Invited)** Correlative Multi-Scale Imaging and Operando Analysis in Sulfide-Based Solid-State Batteries
14:00-14:30	**Demet Sezgin Mansuroğlu (Davetli Konuşmacı)** Elektron Mikroskopisinde Farklı Perspektifler: STEM, ESEM ve Ötesi
14:30-15:00	**Feray Bakan Mısırlıoğlu (Davetli Konuşmacı)** Pigmentten Piksellere: Sanat Eserlerinin Mikroskobik İncelenmesi
15:00-15:30	**Sinem Başkut (Davetli Konuşmacı)** Taramalı Elektron Mikroskobu İncelemelerinde Farklı Numune Hazırlama ve Parametre Seçiminin Rolü

SEPTEMBER 27, 2025

15:30-15:45	**COFFEE BREAK**
	MS and I: Session 6 - A102 Hall Chairs: **Demet Sezgin Mansuroğlu, Sinem Başkut**
15:45-16:15	**Abdülhamit Saraç (Davetli Konuşmacı)** Helyum İyon Mikroskopisi: Gelişmeler ve Yeni Uygulamalar
16:15-16:30	**OP-0069** **Ali Can Zaman** A Novel Route to Sulfurized Carbons for Dual Applications in CO_2 Capture and Lithium–Sulfur Batteries
16:30-16:45	**OP-0052** **Hasan Ali** Atomic Scale Mapping of Magnetic Moments Using a Scanning Transmission Electron Microscope
17:30-18:00	**CLOSING AND AWARD CEREMONY (Conference Hall)**

INVITED SPEAKERS/ DAVETLİ KONUŞMACI SUNUMLARI

Catalyst Characterisation at the Cutting Edge

Dogan Ozkaya[1], Trung Dung Tran[2], Aakash Varambhia[1]

[1]Johnson Matthey Technology Centre

[2]Dıamond Lıght Source Harwell

Electron microscopy contribution to catalyst characterisation has been very significant over the years and with the development of new technology and analysis techniques, its contribution is likely to increase even more in the coming years. One of the most significant recent developments have been the inclusion of counting direct electron cameras in an EELS system in a probe corrected cold field emission Scanning transmission electron microscope (STEM). This has made it possible to obtain not only high signal to noise ratio elemental distributions at atomic resolution but also made 4D STEM related methods such as iDPC and Ptychography a reality both of which help produce images that reduces beam damage significantly as it allows high signal images to be obtained with limited electron dose. In zeolites, it has made it possible to obtain images that show cation positions, and this is likely to solve several technology issues related to use of these microporous materials in the industry such as SCR catalysts. I will go through some of the examples of catalyst characterisation that makes a big difference in understanding that was not available before, such as atomic resolution chemical maps from platinum group elements, atomic resolution oxidation state maps, 4DSTEM of zeolites etc.

I will also discuss a method of analysis of vast amounts of data in an industrial setting that makes a big difference in efficiency by automating the data analysis pipelines using an app store. This has specific home-made apps that helps with specific image analysis tasks, and it is integrated to Laboratory information management systems for report outputs.

Keywords: Catalyst Characterisation, STEM, zeolites, atomic resolution, chemical mapping

Graphene-Engineered Interfaces in Cu_2SnS_3 Thin Films: Microstructural Advancements and Photovoltaic Performance

Recep Zan

Nanotechnology Application and Research Center, Niğde Ömer Halisdemir University, Niğde, Türkiye, Department of Physics, Niğde Ömer Halisdemir University, Niğde, Türkiye.

AIM: The development of cost-effective and environmentally friendly absorber materials is essential for next-generation thin-film solar cells. In this study, we investigated the influence of graphene inclusion on the structural, morphological, and electrical properties of solution-processed Cu_2SnS_3 (CTS) thin films and the consequent performance of CTS-based photovoltaic devices. Graphene was utilized in two distinct roles: as a dopant to CTS films and as an interlayer within the device structure.

MATERIALS-METHODS: CTS thin films were synthesized via a solution-based route. Post-deposition annealing and sulfurization were carried out to optimize crystallinity. Graphene, in powder form, prepared via liquid phase exfoliation, was introduced during the film synthesis. Additionally, high-quality graphene layers were synthesized via chemical vapor deposition and incorporated as interfacial layers within the solar cell architecture. Structural characterization was performed using X-ray diffraction (XRD) and Raman spectroscopy, while surface morphology and elemental composition were examined by scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). Electrical characterization included conductivity and Hall effect measurements. The photovoltaic performance of fabricate d solar cells was evaluated under standard illumination.

RESULTS: XRD and Raman analyses confirmed enhanced crystallinity and phase purity in graphene-doped CTS films. SEM images revealed improved surface uniformity and grain connectivity upon graphene incorporation. EDS verified homogeneous elemental distribution. Electrical measurements demonstrated increased carrier concentration and conductivity in doped films. Devices incorporating both doped CTS absorbers and graphene interlayers exhibited a significant increase in power conversion efficiency compared to undoped counterparts, attributed to improved charge transport and reduced recombination.

CONCLUSION: The incorporation of graphene, both as a dopant and interlayer, effectively enhanced the structural and physical properties of CTS thin films and significantly boosted solar cell performance. These findings highlight synergistic role of graphene in advancing solution-processed CTS-based photovoltaics.

ACKNOWLEDGEMENT: This study was supported by TÜBİTAK under project number 122F217.

Keywords: CTS, thin film, solar cell, photovolatic, graphene

Sharper eyes, deeper insights: Advances in TEM electron diffraction for nanoscale crystallography

Erçin Çağan Duran[1], Feridoon Azough[2], Zhiquan Kho[2], Joshua Einsle[3], Irene Azaceta[4], Adam Kerrigan[5], Vlado Lazarov[4], Mohamed Rafiuddin[6], Yazhou Shen[2], Simon Hunt[2], Anamul Mir[6], Alexander Eggeman[2]

[1]Department of Metallurgical and Materials Engineering, Istanbul Technical University, Türkiye

[2]Department of Materials, University of Manchester, United Kingdom

[3]School of Geographical and Earth Sciences, University of Glasgow, United Kingdom

[4]Department of Physics, University of York, United Kingdom

[5]York-JEOL Nanocentre, University of York, United Kingdom

[6]School of Computing and Engineering, University of Huddersfield, HD1 3DH, United Kingdom

The advances in detector technology significantly improved the electron diffraction data quality in transmission electron microscopes (TEM) which in turn allowed unprecedented characterisation analyses to be conducted on various materials. Traditional charge-coupled devices (CCD cameras) along with photographic films have been largely superseded by direct electron detectors (DEDs) and hybrid pixel detectors. These detectors offer much higher sensitivity, readout speeds and dynamic range as well as incredible signal-to-noise ratios. Due to the availability of these detectors, it is now possible to collect high quality electron diffraction data from beam sensitive materials (which require low electron doses) and also do very fast 4-dimensional scanning transmission electron microscopy (4DSTEM) and electron diffraction tomography experiments.

In order to showcase this, an example of precession electron diffraction tilt series experiment on La-doped $SrTiO_3$ is presented. With this approach a novel nano-scale phase was found and its crystal structure was determined. The data for that study was collected on a CCD camera but the quality was good enough to perform an accurate structure solution and refinement. In addition, a low dose continuous rotation electron diffraction tomography experiment on synthetic rhabdophane ($DyPO_4 \cdot nH_2O$) is also presented. This experiment was performed using a high-speed DED diffraction camera and due to the high data quality, it was possible to determine the disorder in the crystal structure using the diffuse background signals.

Keywords: Electron diffraction, tomography, transmission electron microscopy

Life sciences applications on FIB-SEM

Volkan Erkut[1]

[1] Carl Zeiss Teknoloji Çözümleri Tic. Ltd. Şti., Research Microscopy Solutions (RMS)

AIM: FIB-SEM (Focused Ion beam and Scanning Electron Microscope) technique is being widely used for life science research and its usage is expanding year by year. Ion milling, deposition and TEM lamella preparation are useful for determining the 3D features of biological specimens. For this purpose, this presentation will guide espacially new researchers and expand their knowledge of micro/nano investigation.

MATERIALS AND METHODS: FIB-SEM systems are advanced technological instruments that integrate an electron column with an ion column. While the electron column enables imaging of samples with nanometer-scale resolution and magnification, the ion column allows site-specific modifications such as milling, polishing, and patterning with the same level of precision. These systems are widely used in the life sciences, where the internal structures of resin-embedded or fixed samples can be revealed through sequential milling. Furthermore, following TEM lamella preparation, the integration of a STEM detector into FIB-SEM systems makes it possible to obtain TEM-like images directly within a SEM. Consequently, the combination of sample preparation, high-resolution imaging, and elemental analysis via an integrated EDS detector within a single platform provides laboratories with a highly efficient and practical workflow.

Türkiye Mikroskopi Envanteri ve Mikroskopi Yol Haritası Önerileri

Servet Turan

Eskişehir Teknik Üniversitesi, Mühendislik Fakültesi, Malzeme Bilimi ve Mühendisliği, Eskişehir

1600'lü yıllarda başlayan mikroskop yapımı ve sağlık bilimlerinde, malzeme biliminde, geliştirme ve doğanın anlaşılması çalışmalarında kullanımı her geçen yıl giderek artmış ve 2020'li yılların ortalarında atom seviyesinden makro seviyeye kadar görüntü, element, faz ve 3 boyutlu yapılar hakkında muhteşem veriler elde edebileceğimiz seviyeye ulaşmış ve bu durum birçok Nobel Ödülü'ne konu olmuştur. Günümüzde her türlü çalışma için vazgeçilmez olan mikroskoplar ve bunlara ait aparatlar sayesinde birçok problem başka cihazlara ihtiyaç duyulmadan çözülebilmektedir. Bu sunumda, bu kadar önemli olan elektron mikroskopları, mikroskoplara takılabilen aparatlar olan kimyasal analiz ve faz analiz cihazları ve laboratuvar olarak kullanılabilen odak iyon demeti cihazları konusunda son gelişmeler ve ülkemizde yapılması gerekenler hakkında kendi düşüncelerimden oluşan bir yol haritası önerilecektir.

Anahtar Kelimeler: Mikroskopi, Yol Haritası, Gelişmeler, Türkiye

Elektron mikroskobu ile ileri malzeme ve in-situ karakterizasyon yontemleri

Ugur Unal

Koç Üniversitesi Kimya Bölümü, İstanbul

Koç Üniversitesi Yüzey Bilimi ve Teknolojisi Merkezi (KUYTAM), Koç Üniversitesi ve Kalkınma Bakanlığı'nın desteği ile 2010 yılında kurulmuştur. Türkiye'de yüzey bilimi ve teknolojisi konusunda uzmanlaşmış ilk araştırma merkezidir. KUYTAM, yüzey etkileşimlerini incelemeyi, yüzey fonksiyonlarını optimize etmeyi ve yenilikçi yüzey bazlı ürünler geliştirmeyi amaçlamaktadır. Merkez, 600 m^2 alan üzerine kurulu yedi adet tematik yüzey karakterizasyon laboratuvarından oluşmaktadır. Altyapısı, taramalı elektron mikroskopları, atomik kuvvet mikroskopları, X-ışını floresan spektrometreleri, X-ışını difraktometreleri, X-ışını fotoemisyon spektrometreleri, Raman mikroskopları, ultra hızlı lazer spektrometreleri ve endüktif olarak eşleştirilmiş plazma kütle spektrometreleri gibi 30'dan fazla son teknoloji analitik cihaz içerir. KUYTAM'ın gelişmiş tesisleri akademik ve endüstriyel araştırma ve geliştirme gruplarının kullanımına açıktır. KUYTAM'ın malzeme bilimi ve yüzey çalışmalarına odaklanan akademik ve endüstriyel ortaklarla işbirliği yapmanın yanı sıra kendi araştırma konuları da bulunmaktadır. KUYTAM'daki araştırmacılar merkezde çeşitli projeler yürütmekte ve N2Star gibi Koç Üniversitesi'ndeki diğer araştırma merkezleriyle yakın ilişkiler sürdürmektedir. Konuşmamda Koç Üniversitesi bünyesinde bulunan geçirimli elektron mikroskobu (TEM/STEM) ile yapılan çalışmalar hakkında bilgi vereceğim. Esas olarak KUYTAM'da yürütülen Yüksek Entropili Alaşımlar ve 2D Malzemeler üzerine yapılan araştırmaların sonuçları ve özellikle bu araştırma alanlarında Hitachi TEM/STEM cihazlarının kullanımına odaklanılacaktır. Aynı zamanda üniversite bünyesinde bulunan TEM/STEM cihazı ile yapılan in-situ ve operando çalışmalar ve bu konulardaki kapasitemiz hakkında bilgiler vereceğim.

Anahtar Kelimeler: TEM, STEM, yüksek entropi malzemeler, 2D malzemeler

Atomların Arasında: "TEM ile Nano ve Piko Dünyanın İzinde"

Selçuk Birdoğan

Sabancı Üniversitesi Nano Teknoloji Araştırma ve Uygulama Merkezi (SUNUM), Kocaeli

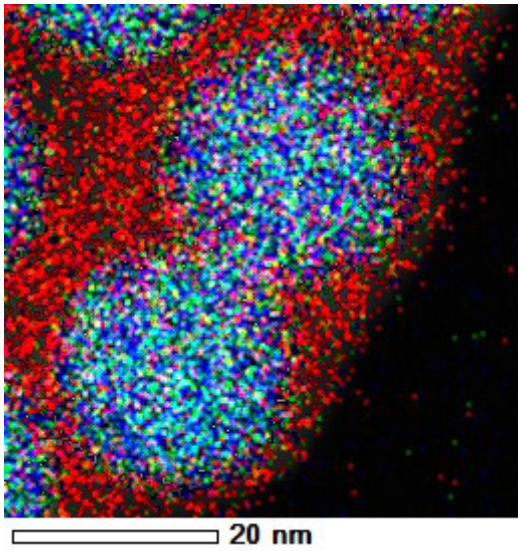
Malzeme biliminin hızla gelişen alanlarından biri olan nanoteknoloji, yapıların atomik ölçekte anlaşılmasını gerekli kılmaktadır. Bu bağlamda Geçirimli Elektron Mikroskobu (TEM), nanometre ve hatta pikometre ölçeğinde çözünürlük sağlayarak araştırmacılara benzersiz bir gözlem imkânı sunmaktadır. TEM sayesinde kristal yapılar, dislokasyonlar, arayüzler, faz geçişleri ve atomik düzen bozuklukları doğrudan incelenebilmekte; böylece hem temel bilimsel sorulara yanıt verilmekte hem de teknolojik uygulamalar için kritik bilgiler elde edilmektedir.

Bu sunumda öncelikle TEM'in çalışma prensipleri ve sağladığı görüntüleme modları (parlak ve karanlık alan, yüksek çözünürlüklü TEM, seçilmiş alan elektron kırınımı) tanıtılacaktır. Ardından, yarı iletken teknolojileri, enerji depolama sistemleri ve biyomalzemeler gibi güncel araştırma alanlarından örneklerle, TEM'in farklı malzeme sınıflarına nasıl uygulanabildiği gösterilecektir.

Sonuç olarak, TEM'in nano ve piko ölçekteki yapısal incelemelere ışık tutarak, bilimin "atomların arasında" yeni bir perspektif geliştirmesine nasıl katkı sağladığı ortaya konulacaktır.

Anahtar Kelimeler: TEM. Nano, Piko, STEM, EDS, EELS

Şekil 1



Demir/Polimer çekirdek/kabuk. Demir nanoparçacıkların üzerine kaplanmış polimer malzemeni STEM-EDS haritalandırmasının üst üste bindirilmiş görüntüsü

TEM ile geleneksel mikroyapı incelemelerini devinimli elektron kırınımı ve in-situ deneyler ile geliştirme

Umut Savacı

Eskişehir Teknik Üniversitesi, Malzeme Bilimi ve Mühendisliği Bölümü, Eskişehir

Mikroyapı ve malzeme özellikleri arasındaki ilişkinin anlaşılması Malzeme Biliminde çok büyük bir öneme sahip olmakla birlikte nano ve altındaki ölçeklerde mikroyapısal bileşenlerin, malzeme özellikleri üzerindeki etkilerini anlayabilmek amacıyla mikroyapı incelemelerinde geçirimli elektron mikroskopları (TEM) yaygın olarak kullanılmaktadırlar. Mikroyapısal bileşenler ele alındığında, malzeme içerisinde yer alan fazların neler oldukları, dağılımları ve fazlar arasındaki kristalografik oryantasyon ilişkileri gibi mikroyapısal özelliklerin malzeme özellikleri üzerindeki etkileri önemli bir yere sahiptir. Bu tür mikroyapısal bileşenlerin incelenmesi amacıyla taramalı elektron mikroskoplarında elektron geri saçılma tekniği (EBSD) yaygın olarak kullanılıyor olsa da bu yöntemin çözünürlük sınırlamaları nedeniyle yüksek çözünürlükte faz ve oryantasyon incelemeleri gerçekleştirilememektedir. Bu amaçla geliştirilen TEM ile devinimli elektron kırınımı (PED) yöntemi kullanılarak geleneksel TEM yöntemlerine ek mikroyapısal bilgilerin yüksek çözünürlükte elde edilebilmesi mümkün olabilmektedir. Ayrıca son yıllarda gelişen in-situ numune tutucu teknolojileri ile de mikroskoplar içerisinde deney düzeneklerinin kurulabilmesi mümkün hale gelebilmiş ve mikroyapı incelemelerinin malzemenin çalışma koşullarında veya yakın koşullarda mikroyapısal değişimlerinin gerçek zamanlı olarak takip edilebilmesini mümkün hale getirmiştir. Yeni geliştirilmiş olan bu teknikler ile geleneksel mikroyapı incelemelerine ek bilgiler elde edilerek mikroyapı hakkında daha fazla bilgiye sahip olabilmemiz mümkün olmakta olup, bu sunumda farklı basınçlı sinterleme yöntemleri ile üretilmiş seramik kompozitlerin mikroyapısında yer alan fazlar arasındaki oryantasyon ilişkilerinin PED yöntemi ile incelenmesinin yanı sıra çeşitli in-situ ısıtma deneyleri ile elde edilmiş mikroyapı incelemelerinde elde edilen sonuçlar paylaşılacaktır.

Anahtar Kelimeler: Devinimli elektron kırınımı, TEM, in-situ ısıtma

FIB ile nano ölçekli işlemler ve ileri seviye uygulamalar

Mustafa Güler

Bilkent Üniversitesi UNAM Ulusal Nanoteknoloji Araştırma Merkezi, Ankara

AFM Tip Modifikasyonları, FIB ile özel kaplamalar ve fonksiyonel uç tasarımları ile nano ölçekte yüzey analizi ve manipülasyon.
Seramik Numunelerin 3D Görüntülenmesi (FIB Auto Slice & View): Odaklanmış iyon demeti ile otomatik katmanlı kesit alma ve 3D görüntüleme
FIB Doğrudan Litografi (Direct Lithography): Nano yapıların maskesiz litografi yöntemiyle doğrudan yazılması.
FIB ile Elmas Kesici Modifikasyonu: Kesici uç geometrisinin nano hassasiyette düzeltilmesi ve performans optimizasyonu.
FIB ile MEMS Device Testleri: Mikro elektro-mekanik sistemlerde (MEMS) devre kesme, modifikasyon ve hata analizi.
Mikroçip Modifikasyonu: Entegre devrelerde hata analizi, devre yeniden bağlantısı ve güvenlik testleri.
Nanoindenter için Numune Hazırlama: Yüksek hassasiyetli nano mekanik testler için uygun yüzey hazırlığı.
Mikropiller ve İnce Film Analizi: FIB ile boyutlu gözlem için mikropiller numuneler için yeni bir üretim yöntemi
Geçirimli elektron mikroskobu için numune hazırlama teknikleri.
Omni probe ile numune taşıma teknikleri

Anahtar Kelimeler: fib, afm, mems

Yumuşak Malzemelerden Sert Malzemelere İleri Düzey Odaklanmış İyon Demeti (FIB) Uygulamaları

Büşra Tuğba Çamiç

Sabancı Üniversitesi Nanoteknoloji Araştırma ve Uygulama Merkezi (SUNUM), Büşra Tuğba Çamiç, İstanbul

Odaklanmış iyon demeti (FIB) teknolojisi, mikro/nano ölçekli paternleme ve karakterizasyon, üç boyutlu analiz, TEM lamella hazırlama gibi ileri düzey uygulamalarda kritik bir yöntem olarak öne çıkmaktadır. Bu çalışmada, FIB sisteminin farklı malzeme sınıflarına yönelik uygulanabilirliği ve gelişmiş kullanım alanları kapsamlı biçimde incelenmiştir.

Araştırma kapsamında; diş, böcek duyu organları ve insan dokuları gibi biyolojik malzemeler ile metal katkılı biyobozunur ve biyouyumlu polimerler dahil olmak üzere, hem yumuşak hem de sert malzemelerin nano ve mikro ölçekte morfolojik ve kimyasal özellikleri sistematik olarak karakterize edilmiştir. Odaklanmış İyon Demeti–Taramalı Elektron Mikroskobu (FIB-SEM) sistemi kullanılarak eş zamanlı kesitleme ve görüntüleme teknikleri uygulanmış, böylece iç morfolojik ve kimyasal özelliklerin değişimleri üç boyutlu olarak araştırılmıştır. Alınan kesitlerden element dağılım haritaları, Enerji Dağılımlı X-ışını Spektroskopisi (EDS) ile oluşturulmuştur. Ayrıca, çalışmada metal alaşımlarından polimer malzemelere kadar geniş bir yelpazede TEM lamella hazırlama yöntemleri değerlendirilmiştir.

Sonuç olarak, bu çalışma, FIB teknolojisinin hem yumuşak hem de sert malzemelerde morfolojik, yapısal ve kimyasal analizler için esnek ve güçlü bir platform sunduğunu ortaya koymaktadır. Bu yaklaşım; malzeme bilimi, biyomalzeme araştırmaları ve nanoteknoloji alanlarında yürütülen ileri düzey karakterizasyon çalışmalarına önemli katkılar sağlamaktadır.

Anahtar Kelimeler: FIB, 3D analiz, Çift Demet Platform

Elektron Mikroskopisinde Farklı Perspektifler: STEM, ESEM ve Ötesi

Demet Sezgin Mansuroğlu

Boğaziçi University, Istanbul

Pigmentten Piksellere: Sanat Eserlerinin Mikroskobik İncelenmesi

Feray Bakan Mısırlıoğlu[1]

[1] Sabancı University Nanotechnology Research and Application Center (SUNUM), Istanbul, Turkiye

Sanat eserlerinin bilimsel incelenmesi, kültürel miras araştırmalarında giderek daha güçlü bir araç haline gelmiş ve malzeme bilimi ile sanat tarihini bir araya getirmiştir. Bu sunumda, tarihî eserlerdeki pigmentler, bağlayıcılar ve bozunma ürünlerini incelemek amacıyla kullanılan mikroskobik ve spektroskopik teknikler ele alınacaktır. Pigment ölçeğinden piksel düzeyine uzanan bu yaklaşımda, yüksek çözünürlüklü görüntüleme, Raman spektroskopisi, SEM-EDS ve hiperspektral analiz gibi yöntemlerin hem eserlerin malzeme bileşimini hem de korunma durumlarını aydınlatmadaki katkıları vurgulanacaktır.

Vaka çalışmaları, bu tekniklerin gizli katmanları ortaya çıkarmadaki, özgün malzemeler ile sonraki restorasyon müdahalelerini ayırt etmedeki ve eserlerin uzun vadeli korunmasını tehdit eden bozunma süreçlerini takip etmedeki rolünü gösterecektir. Ayrıca, ileri görüntüleme tekniklerinin hesaplamalı yaklaşımlarla bütünleştirilmesi, yalnızca kimyasal dağılımları görselleştiren değil, aynı zamanda koruma stratejilerine rehberlik eden dijital haritaların oluşturulmasına olanak tanımaktadır.

Bu disiplinlerarası yaklaşım, malzeme biliminin koruma kararlarını nasıl bilgilendirdiğini, eserlerin özgünlüğünü doğrulamaya katkıda bulunduğunu ve sanat üretim süreçlerine daha derinlemesine bir bakış sunduğunu ortaya koymaktadır. Sonuç olarak, "pigmentten piksellere" uzanan bu yolculuk, bilimsel hassasiyet ile kültürel sorgulamanın ortak mirasımızın korunmasındaki uyumunu gözler önüne sermektedir.

Taramalı Elektron Mikroskobu İncelemelerinde Farklı Numune Hazırlama ve Parametre Seçiminin Rolü

Sinem Başkut

Eskişehir Teknik Üniversitesi, Eskişehir

Helium Ion Microscopy: Advancements and Emerging Applications

Abdulhamit Sarac

Department of Mechanical Engineering, University of Michigan, Ann Arbor, MI, 48109, USA

The Helium Ion Microscope (HIM) is a unique microscopy system that employs a Gas Field Ion Source (GFIS), enabling the use of inert gases such as helium and neon for imaging. This allows the instrument to achieve sub-nanometer spatial resolution, down to approximately 0.5 nm, while also providing an exceptional depth of focus. The imaging process begins with the formation of a three-atom structure, referred to as a trimer, at the cryogenically cooled, atomically sharp tungsten tip under ultra-high vacuum and a positive acceleration voltage. The atoms at the tip apex interact with helium gas atoms, leading to their ionization. The system is then aligned to the brightest atom in the trimer, producing a focused helium ion beam with a diameter of approximately 0.5 nm. The helium ion beam strikes the surface of the material, and the emitted secondary electrons are collected by the Everhart–Thornley detector to form the final image. The microscopy system is further equipped with a gallium focused ion beam (Ga-FIB) column, a needle-based Gas Injection System (GIS) for delivering precursor gases to enhance milling operations, and a flood gun for neutralizing positive surface charges. In addition, it can be configured with accessories for Transmission Electron Microscope (TEM) lamella preparation and Secondary Ion Mass Spectrometry (SIMS) analysis. The system was commercialized in 2007 and has been widely used since 2010 particularly for applications ranging from biological imaging without coatings to advanced nanofabrication. This study focuses on recent developments in HIM applications, with particular emphasis on advancements from the past five years, highlighting its emerging role in quantum sensing and nanophotonic technologies. HIM enables precise engineering of defects, such as nitrogen vacancies in diamond single crystals and nanopores in 2D monolayers like hBN and MoS_2, facilitating direct-write nanofabrication of Josephson junctions, plasmonic nanoantennas, and other functional nanoscale devices.

Makro ve Supra-Biomoleküllerin Zaman Çözünürlüklü Yapısal Kriyo-Elektron Mikroskopi Çalışmaları

Hasan Demirci

Koc University, Collage of Science, Istanbul, Turkiye

Ribozomlar gibi makro ve supramoleküler kompleksler, biyolojik işlevlerini yerine getirirken son derece dinamik yapısal değişimlere uğrarlar. Bu dinamik ara durumların yüksek zamansal çözünürlükle yakalanması, biyolojik süreçlerin mekanistik anlaşılmasında kritik öneme sahiptir. Geleneksel kristalografi ve kriyo-elektron mikroskopisi (Kriyo-EM) yöntemleri birçok statik ara durumu çözümlemiş olsa da, biyolojik olarak anlamlı milisaniye-saniye zaman ölçeklerinde gerçekleşen geçici ara durumlar hakkında bilgilerimiz sınırlıdır. Laboratuvarımızda geliştirdigimiz zaman çözünürlüklü seri femtosaniye kristalografisi (TR-SFX) yaklaşımı ile Thermus thermophilus 30S ribozomal alt ünitesinin IF1 ile etkileşimlerini 200 ms zaman penceresinde gözlemledik. Bu veriler, ribozomun çözümleme merkezi (A1492/A1493, 530-loop ve uS12) üzerinde IF1 aracılı yeniden düzenlenmeleri ortaya koydu. Buna paralel olarak, zaman çözünürlüklü Kriyo-EM (TR-KriyoEM) çalışmalarımız, örneklerin milisaniye ölçeğinde karıştırılarak hızla dondurulması yoluyla bu geçici ara durumların yakalanmasına olanak sağlamaktadır. TR-KriyoEM, XFEL tabanlı yöntemlere tamamlayıcı bir strateji sunarak, ribozom dinamiklerinin ve protein-RNA etkileşimlerinin dört boyutlu (zaman dahil) haritalanmasını mümkün kılmaktadır. Sonuç olarak, TR-SFX ve TR-KriyoEM yöntemlerinin entegrasyonu, ribozom biyolojisinin yanı sıra antibiyotik-ribozom etkileşimleri ve translasyonel düzenleme gibi birçok alanda çığır açıcı bilgiler sağlayacaktır.

Eklemeli İmalatla Üretilen Metalik Malzemelerin EBSD Tekniği ve TEM Kullanılarak Mikroyapı ve Kristalografik Dokusunun İncelenmesi

Merve Nur Doğu[1], Dermot Brabazon[2], Mustafa Alp Yalçın[3], Seren Özer[4], Kemal Davut[5]

[1]I-Form Advanced Manufacturing Research Centre, Dublin City University, Dublin, İrlanda

[2]School of Mechanical & Manufacturing Engineering, Dublin City University, Dublin, İrlanda

[3]Metal Şekillendirme Mükemmeliyet Merkezi, Atılım Üniversitesi, Ankara, Türkiye

[4]Metalurji ve Malzeme Mühendisliği Bölümü, Atılım Üniversitesi, Ankara, Türkiye

[5]Malzeme Bilimi ve Mühendisliği Bölümü, Izmir İleri teknoloji Enstitüsü, Urla, İzmir, Türkiye

AMAÇ: Eklemeli imalat teknikleri, tasarımda daha fazla özgürlük, net şekle yakın imalat, düşük maliyet gibi konularda geleneksel üretim tekniklerine göre avantajlar sağlar. Yüksek soğuma hızı ve buna bağlı hızlı katılaşma denge-dışı fazların oluşmasına, çökelmelerin engellenmesine, mikro-segregasyonlara neden olur ve mekanik özellikleri bozar. Eklemeli imalatla üretilen IN718'in mekanik özelliklerini iyileştirmek için solüsyona alma ve yaşlandırma gibi ısıl işlemler uygulanır. Bu çalışmanın amacı,eklemeli imalatla üretilen IN718 parçaların mikro-yapı ve kristalografik dokusu üzerinde ısıl işlemlerin etkisini anlamaktır.

MALZEME ve METHOD: Seçici lazer eritme (SLM) ile IN718 numunelerinin üretimi için gaz atomizyonla elde edilmiş küresel IN718 tozları kullanılmıştır. Uzunlamasına eksenleri yığma yönüne paralel (dikey yapım) ve yığma yönüne dik (yatay yapım) olacak şekilde silindirik numuneler üretilmiştir. Sonrasında farklı sıcaklık ve süreler kullanılarak numunelere çeşitli çözeltiye alma ve yaşlandırma işlemleri uygulanmıştır. Numunelerin içyapı ve kristalografik dokusu, FEG-SEM, EDS, EBSD ve TEM teknikleri kullanılarak karakterize edilmiştir.

BULGULAR: Seçici lazer ergitmeyle üretim sonrası numune çanak şeklinde eriyik havuzlarından ve satranç tahtası benzeri tane yapısından oluşmaktadır; ayrıca küp kristalografik dokusuna sahiptir. 1150°C'de 15 dakika boyunca tavlanmış numunelerde yeniden kristalleşmiş tanelerin oluşmaya başladığı gözlemlenmiştir. Yeniden kristalleşme, üst-üste binen eriyik havuzları ve satranç tahtası benzeri desenin kenarları gibi dislokasyon yoğunluğu yüksek bölgelerde başladığı gözlemlenmiştir. Başlangıçtaki küp dokusu, ikizleme destekli yeniden kristalleşme mekanizması yoluyla farklı bir kristalografik dokuya dönüşmektedir. Yeniden kristalleşmenin devamı sırasında neredeyse hiç yeni ikiz oluşmadığı sonucuna varılmıştır. Ancak, matrisle bağdaşık olmayan çökeltilerin varlığı nedeniyle yeniden kristalleşmiş tanelerin büyümesi çok sınırlıdır. Yaşlandırmayla birlikte nano boyutlu γ" ve/veya γ' çökeltiler oluşmuştur; ancak, imal edilmiş numunelerde karşılaşılan MC tipi karbürler ve Laves fazı yaşlanma sonrasında tamamen çözünmemiştir.

SONUÇ: Eklemi imalat yöntemleriyle üretilen IN718 alaşımlarının ısıl işleme verdikleri tepki, geleneksel tekniklerle üretilenlerden farklıdır. Eklemeli imalatla ilişkili hızlı katılaşma, daha yüksek kusur yoğunluğuna neden olur ve bu da yeniden kristalleşme, tane büyümesi ve çökelmenin mekanizmalarını ve kinetiğini etkiler.

Anahtar Kelimeler: eklemeli imalat, EBSD, yeniden kristallenme, tane irileşmesi, çökelim pekleşmesi

Correlative Multi-Scale Imaging and Operando Analysis in Sulfide-Based Solid-State Batteries

Pinar Kaya

Materials Research Institute, Aalen University of Applied Sciences, Aalen, Germany

All-solid-state batteries (ASSBs) have emerged as a promising technology to address the current risks and limitations of conventional liquid electrolyte-based Li (and potentially Na) ion batteries. However, achieving ASSBs with competitive cell performance remains challenging. Despite notable progress in recent years, several issues persist at the material, electrode, and cell levels. These include insufficient interfacial contact and electrochemical instability between the cathode active material (CAM) and the solid electrolyte (SE) within composite cathodes (CCs), as well as residual porosity and mechanical strain/stress arising from processing and cycling. Furthermore, inadequate ionic and electronic transport pathways continue to hinder performance [1,2]. To address these challenges and to deepen our understanding of performance-limiting mechanisms and processability, it is essential to correlate microstructural and electrochemical properties across multiple length scales. Operando analyses, in particular, offer valuable insights into these interdependencies [3]. In this work, I present an inert-gas-compatible workflow that combines high-resolution X-ray microscopy (XRM) with correlative femtosecond-laser/FIB sample preparation and FIB-SEM tomography. Complementary EDS analysis provides additional information on active surface area and the formation of reaction products during processing and cycling. Moreover, operando and in-situ FIB-SEM studies of sulfidic Li- and Na-ion ASSBs are shown to reveal microstructural evolution during cycling. This synergistic workflow contributes to a more comprehensive understanding of ASSB microstructure across different length scales and its influence on the electrochemical behavior of complete cells and individual components.

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Keywords: Correlative microscopy, Operando analyses, Solid state batteries

ORAL PRESENTATIONS/ SÖZLÜ BİLDİRİLER

OP-0085 - Main Topics in Material Sciences - Energy and Microscopy

Correlating grain size control in FAPbI3 perovskite solar cells with device quality: Insights from high-resolution electron microscopy

Birsen Sahin[1], Ravza Ceylin Amman[1], Seçkin Akin[2], Muhittin Unal[3], Bülent Alkan[4]

[1]Laboratory of Advanced Materials & Photovoltaics (LAMPs) Necmettin Erbakan University Konya 42090 Turkiye, Department of Metallurgical and Materials Engineering Necmettin Erbakan University Konya 42090 Turkiye

[2]Laboratory of Advanced Materials & Photovoltaics (LAMPs) Necmettin Erbakan University Konya 42090 Turkiye, Department of Metallurgical and Materials Engineering Necmettin Erbakan University Konya 42090 Turkiye, M Solar Optoelectronic Materials Co., www.mperovskite.com

[3]Laboratory of Advanced Materials & Photovoltaics (LAMPs) Necmettin Erbakan University Konya 42090 Turkiye, Department of Electrical and Energy, Tufanbeyli Vocational School, Cukurova University, Adana 01640, Turkiye

[4]Laboratory of Advanced Materials & Photovoltaics (LAMPs) Necmettin Erbakan University Konya 42090 Turkiye, Department of Metallurgical and Materials Engineering, Hitit University Çorum 19030 Turkiye, Inspire Material Co., www.inspirematerial.com

Perovskite solar cells (PSCs) have shown significant progress due to their high power conversion efficiencies and low-cost processing. However, achieving high-quality perovskite films remains a challenge, especially in controlling grain size and morphology. Grain boundaries often act as recombination centers, so enlarging grains reduces defects and improves device performance (Ebic et al., 2024; Li et al., 2024; Siddiqui et al., 2024). In this study, we focused on enhancing the microstructure of $FAPbI_3$ films by controlling crystallization to promote larger, more uniform grains. Characterization is essential to confirm the success of such improvements. Scanning electron microscopy (SEM) was used to observe surface morphology and grain structure, providing direct evidence of microstructural changes. SEM analysis played a crucial role in correlating thin film morphology with enhanced photovoltaic performance and validating our approach.

The device architecture comprised five functional layers: FTO substrate, electron transport layer (ETL), $FAPbI_3$ absorber layer, hole transport layer (HTL), and a top metal electrode. The perovskite precursor solution was prepared under an inert nitrogen atmosphere and deposited by spin-coating, followed by thermal annealing in a dry environment to ensure proper crystal formation. Subsequent layers were deposited using standard techniques, including physical vapor deposition (PVD) for the metal contact. To evaluate the effect of processing modifications, a combination of structural and optoelectronic characterization techniques was employed.

In this study, we aimed to improve thin-film quality by producing larger and more uniform grains. To achieve this, we modified the crystallization process by controlling the nucleation and growth of the film. Larger grains reduce the number of grain boundaries, which are known to limit electrical performance. As a result, better grain structure directly improved the device quality as compared as the control film. SEM was essential for observing these changes, allowing us to clearly visualize grain size, surface coverage, and film uniformity.

Keywords: Perovskite solar cells, Nucleation and growth mechanism, Surface characterization

OP-0091 - Main Topics in Material Sciences - Metals and Alloys

Microstructural Characterization and Micropillar Fabrication of Austenitic Stainless Steel for Further Microscale Compression Studies

Halil Yilmaz[1], Bülent Alkan[2]

[1]Department of Mechanical and Metal Technologies, Mus Alparslan University, 49250, Mus, Turkiye

[2]Department of Metallurgy and Materials Engineering, Hitit University, 19030, Corum, Turkiye

AIM: This study aims to characterize the microstructure of wrought 316L stainless steel at the microscale and to fabricate site-specific micropillars using focused ion beam (FIB) milling. The ultimate goal is to prepare the material for future micro-compression testing to investigate its deformation behavior and size-dependent mechanical response.

MATERIALS-METHODS: Microstructural characterization was performed using scanning electron microscopy (SEM) and electron backscatter diffraction (EBSD) to assess grain morphology, crystallographic orientation, and texture. Freestanding micropillars (800–3000 nm in diameter) were fabricated using a Zeiss Crossbeam 540 SEM-FIB system. A stepwise milling strategy was applied: high Ga ion currents were initially used for rapid material removal, followed by progressively lower currents (down to 10 pA) for final pillar dimension. [001]-oriented pillars were fabricated with aspect ratios between 2.8 and 3.4 and taper angles of 2°–4° to ensure geometric precision and suitability for future uniaxial compression testing.

RESULTS: EBSD analysis revealed an equiaxed grain structure with a relatively random crystallographic orientation distribution, typical of wrought austenitic stainless steels. Grain sizes varied from 15 to 50 µm. The fabricated micropillars with diameters ranging between 800 nm to 3 µm exhibited smooth sidewalls, consistent diameters, and were successfully positioned within [001]-oriented grains. The preparation quality confirms the suitability of the samples for subsequent in-situ mechanical testing.

CONCLUSION: The detailed microstructural analysis and successful fabrication of micropillars with different diameters from wrought 316L SS establish a solid foundation for future microscale mechanical testing. These micropillars, with well-controlled geometry and crystallographic orientation, are ideally suited for investigating fundamental deformation mechanisms such as dislocation starvation, strain localization, and size effects. The insights gained from future testing of these micropillars can contribute to the design of reliable, high-performance materials for critical applications in microengineering, nuclear materials research, and structural components exposed to extreme environments.

Keywords: Micropillar fabrication, 316L stainless steel, Nanoindentation

OP-0112 - Main Topics in Material Sciences - Ceramics

Assessment of the Effects of İzmit Gulf Sediment on the Microstructural and Technical Characteristics of Porcelain Tiles

Nermin Demirkol[1], Neslihan Tamsü Selli[2]

[1]Department of Ceramics, Kocaeli University, Kocaeli, Türkiye

[2]Department of Materials Science and Engineering, Gebze Technical University, Kocaeli, Türkiye

AIM: In line with the "Izmit Bay East Basin Bottom Sludge Cleaning, Dewatering and Disposal Service" Project in cooperation with the Ministry of Environment, Urbanization and Climate Change and Kocaeli Metropolitan Municipality, 8.5 million tons of bottom sludge will be removed within 5 years in the bottom sludge cleaning carried out since May 2023 [1,2]. In today's world, recycling waste materials, utilizing alternative local raw resources, and adopting environmentally conscious approaches have become essential. The aim of this study is to investigate the usability of this waste material as a raw material in porcelain tile production with microstructural and technical investigations.

MATERIALS-METHODS: In this study, bottom mud waste from the İzmit Gulf was incorporated into porcelain tile formulations as a partial substitute for clay at weight ratios of 5%, 10%, and 15%. The specimens were sintered under industrial firing conditions at 1220°C, and their firing shrinkage, bulk density, green and fired flexural strength, and water absorption properties were analyzed and compared to those of conventional porcelain tiles. Phase identification was conducted via X-ray diffraction (XRD), while microstructural features were examined through scanning electron microscopy (SEM).

RESULTS: Notably, the compositions containing 10% bottom mud demonstrated the most favorable outcomes: green strength was twice that of the reference sample, and the fired strength peaked at 85 MPa.
CONCLUSION: This composition is highlighted as a promising candidate for producing more cost-effective, sustainable, and eco-friendly porcelain tile products.

ACKNOWLEDGEMENTS
This study was supported by Kocaeli University Participatory Research Project in collaboration with Gebze Technical University, Project Number: FKA-2024-4084. As all authors, we would like to express our gratitude to Kocaeli University Scientific Research Projects Directorate for their support.

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2) https://www.kocaeli.bel.tr/hizmet/izmit-korfezi-dip-camuru-temizligi-90.html

Keywords: Bottom mud, İzmit Gulf, sustainability, porcelain tile, microstructure, technical

OP-0069 - Malzeme Bilimleri Ana Konuları - Karbon Temelli Malzemeler

A Novel Route to Sulfurized Carbons for Dual Applications in CO_2 Capture and Lithium–Sulfur Batteries

Ali Can Zaman[1], Esma Nur Coşkun[1], Doğa Türkdoğan[1], Hasan Mert Kaymak[1], Furkan Şahin[1], Muhammed Ercan[1], Paul Braun[2], Suna Avcıoğlu[1], Figen Kaya[1], Cengiz Kaya[1]

[1]Department of Metallurgical and Materials Science Engineering, Faculty of Chemistry and Metallurgy, Yildiz Technical University, Istanbul, Turkiye

[2]University of Illinois at Urbana-Champaign, Department of Materials Science and Engineering, Illinois (61801), United States

AIM: There is growing demand for efficient, sustainable adsorbent materials tailored for applications such as lithium–sulfur (Li–S) batteries and post-combustion CO_2 capture. This study presents a strategy for converting elemental sulfur—a petrochemical by-product—and volatile organic compounds (VOCs) into functional carbonaceous materials. The goal is to create sulfur-doped porous carbon for use in separator coatings for Li–S batteries and CO_2 adsorbents.

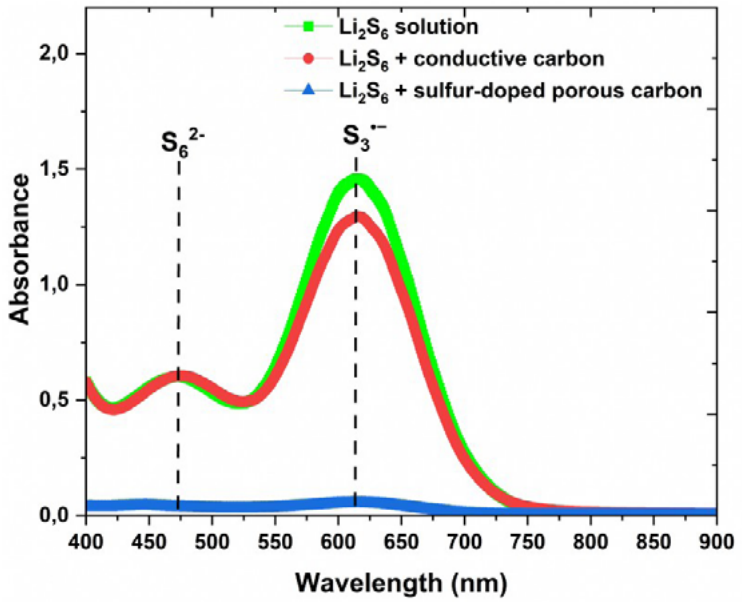
MATERIALS-METHODS: A novel free-radical polymerization method was developed using sealed vials without hydrothermal conditions. A ketonic VOC was converted in situ into an unsaturated intermediate, enabling crosslinking with sulfur. The resulting polymer was sulfur-rich and thermally treated at 800 °C under CO_2 to yield a polar, microporous carbon material. The carbon was applied as a thin separator coating (<0.2 mg/cm^2) in Li–S coin cells via ultrasonication, ball milling, and tape casting. Comparative tests were conducted using uncoated and conventionally coated separators. Volumetric gas sorption was used to assess CO_2 capture at 273 K, 298 K, and 313 K.

RESULTS: Following activation, the carbon material retained ~20 wt% sulfur, exhibited a BET surface area of 1007 m^2/g, and had an average pore diameter of ~1 nm. The maximum CO_2 uptake was 4.1 mmol/g at 273 K, with high CO_2/N_2 selectivity. UV-Vis studies confirmed strong polysulfide adsorption (Fig. 1). In Li–S battery tests, the sulfurized carbon-coated separators achieved an initial discharge capacity of 927 mAh/g at 0.05C, outperforming the control (~800 mAh/g), despite low active carbon coating load (3.5 wt%, EDS).

CONCLUSION: This work demonstrates a scalable, waste-to-resource pathway to produce multifunctional materials for CO_2 capture and energy storage. Future work will focus on electrochemical stability and sulfur–carbon interactions. Funding: TUBİTAK (2209A-919B012421052), Yildiz Technical University (FBA-2024-6061).

Keywords: polymer, sulfur, carbon, lithium sulfur battery, CO2 capture

Figure 1



Ultraviolet–Visible (UV–Vis) Spectroscopy-Based Polysulfide Adsorption Test

OP-0052 - Main Topics in Microscopy Techniques - Advanced Microscopy Techniques

Atomic scale mapping of magnetic moments using a scanning transmission electron microscope

Hasan Ali[1], Hasan Ali[2], Jan Rusz[3], Daniel E. Bürgler[4], Joseph Vas[2], Lei Jin[2], Roman Adam[4], Claus M. Schneider[4], Rafal E. Dunin Borkowski[2]

[1]Department of Materials Science and Engineering, Uppsala University, Uppsala, Sweden

[2]Ernst-Ruska Centre for Microscopy and Spectroscopy with Electrons (ER-C), Forschungszentrum Jülich, Jülich, Germany

[3]Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden

[4]Peter Grünberg Institute, Forschungszentrum Jülich, Jülich, Germany

In an analogy to x-ray based technique XMCD [1], it was proposed and later on experimentally demonstrated [2] that the detection of magnetic dichroic effect is feasible in transmission electron microscope by recording electron energy loss spectra (EELS) under specific diffraction conditions. Considering the spatial resolution of analysis achievable in a TEM, electron magnetic circular dichroism (EMCD) comes with a promise to map the magnetic moments with atomic resolution. Previously, EMCD signals have been detected with atomic plane resolution under parallel illumination conditions. However, these experiments are only possible with a chromatic aberration corrected TEM, restricting the technique to a few laboratories. Generally, the resolution of EMCD analysis is defined by the diameter of electron probe which, in modern probe-corrected scanning TEMs (STEM) can easily reach atomic resolution. Yet, atomic resolution EMCD experiments in STEM mode remain elusive due to challenges associated with convergent beam setups. Here, we report the detection of quantitative STEM-EMCD signals at atomic plane resolution [3]. In our experiments carried out on an Fe crystal, we not only determine the orbital to spin moments ratio (mL/mS) of individual (110) atomic planes of Fe but also detect local variations of mL/mS at sub-atomic plane scales. This work opens the possibility of mapping magnetism at sub-atomic scales in technologically interesting material systems.

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Keywords: EMCD, scanning transmission electron microscope, atomic plane resolution, EELS

POSTER PRESENTATIONS/ POSTER BİLDİRİLERİ

PP-01 - Main Topics in Material Sciences - Catalytic Materials

Ni, Co, Cu, and Fe-Doped TiO_2 Aerogels: Structure, Phase Transformation, and Photocatalytic Activity

Lizeth Katherine Tinoco Navarro[1], Vendula Bednarikova[1], Jaroslav Kastyl[2], Cihlar Jaroslav[1]

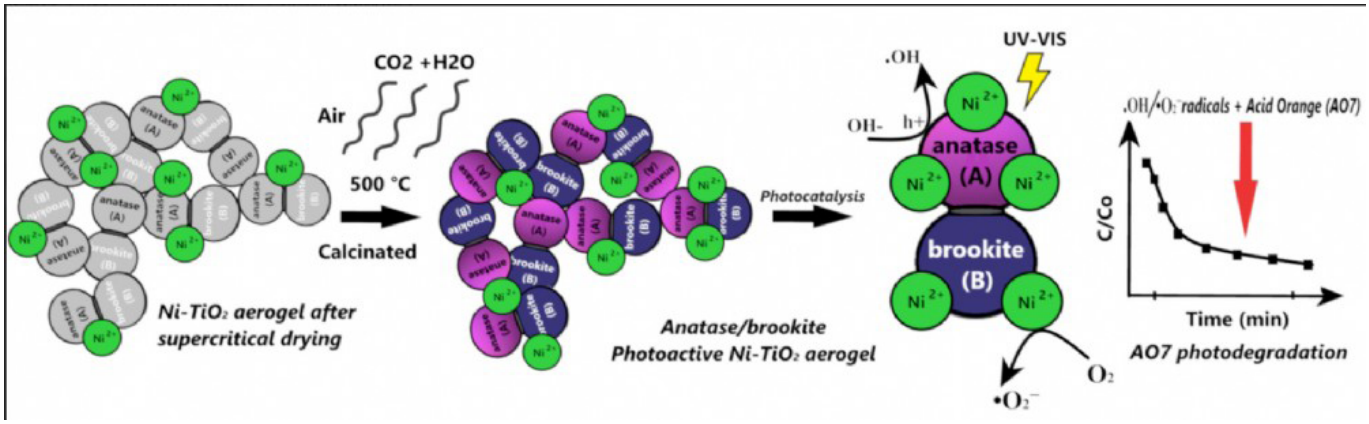
[1]Central Institute of Technology CEITEC

[2]TESCAN

Nickel, cobalt, copper, and iron-doped TiO_2 aerogels were synthesized and investigated for their structural characteristics and photocatalytic performance in degrading the model pollutant acid orange (AO7). The aerogels were calcined at 500 °C and 900 °C, and their composition and morphology were systematically analyzed. XRD confirmed the coexistence of anatase, brookite, and rutile phases, along with additional oxide phases from the dopants. SEM and TEM revealed the nanostructured morphology, while BET measurements demonstrated mesoporosity with high specific surface areas ranging from 130 to 160 $m^2 \cdot g^{-1}$. The incorporation and chemical state of the dopants (1–5 wt.%) were confirmed by SEM–EDS, STEM–EDS, XPS, EPR, and FTIR analyses. Photocatalytic activity was assessed via UV spectrophotometry through AO7 degradation. Ni–TiO_2 and Cu–TiO_2 aerogels calcined at 500 °C exhibited the highest apparent rate constants (k_app), whereas samples calcined at 900 °C showed drastically reduced activity—up to tenfold lower—due to the conversion of anatase/brookite into rutile and the deterioration of textural properties.

Keywords: aerogels; anatase; brookite; transition metal ions; photocatalysis

Graphical Abstract



Graphical Abstract

PP-40 - Main Topics in Material Sciences - Energy and Microscopy

Electrosynthesis of Feldspar-Doped Polypyrrole Coating and Mikrosupercapacitor Application

Gülsüm Sıla Küçükarslan, Erhan Karaca, Nuran Özçiçek Pekmez

Hacettepe Üniversitesi Fen Fakültesi Kimya Bölümü

AIM: Supercapacitors are electrochemical energy storage systems that have been intensively investigated for their high-power density, long cycle life, superior thermal resistance and low maintenance cost [1]. Since the amount of stored electrical energy depends on the type of supercapacitor electrodes and their surface morphology, the effect of electrode materials on capacitor performance has been widely studied in the literature [2,3]. This study aims to investigate the capacitive properties of electrochemically synthesized feldspar-doped polypyrrole (PPy/feldspar) electrode material, a composite of conducting polymer and clay mineral, in a microsupercapacitor cell. In addition, the study presents the fabrication of the micro-supercapacitor utilising laser-induced graphene (LIG), which is a cost-effective and straightforward technique. The capacitive properties were investigated using cycling voltammetry (CV), galvanostatic charge-discharge(GCD) and electrochemical impedance spectroscopy (EIS) methods.

RESULTS: Homogeneous PPy/feldspar composite was successfully electrochemically coated on the surfaces of the graphite disk electrode and the LIG in acetonitrile. The capacitive properties of the coating were significantly enhanced after the addition of feldspar. According to the characterization studies, FESEM images of PPy/feldspar on LIG showed nanorods and porous morphology. XRD and XPS indicated the encapsulation of feldspar in PPy. The symmetric cell was constructed with PPy/feldspar electrode using PVA/H2SO4/Na2SO4 gel electrolyte and tested using CV, GCD and EIS. It exhibited good capacitive behavior in a potential range of -0.4 to 0.8 V, while the charge transfer resistance (Rct) decreased. While the single microsupercapacitor cell delivered 0.8 V cell voltage, five series-connected cells gave 4 V.

Keywords: Energy storage, laser induced graphene, supercapacitor, polypyrrole, FE-SEM

PP-51 - Main Topics in Material Sciences - Energy and Microscopy

Power of doping in energy harvesting: enhancing thermoelectric performance in half-Heusler

Kerem Eyuboglu, Sualp Karayel, Enes Ibrahim Duden, Servet Turan

Department of Materials Science and Engineering, Faculty of Engineering, Eskisehir Technical University, Eskisehir, Turkiye

The growing demand for sustainable energy has increased the interest in thermoelectric materials, which can directly convert waste heat into electricity. These materials enable the design of thermoelectric power generators, offering a pathway to renewable energy production and contributing to the United Nations Sustainable Development Goals on clean and affordable energy. Among them, double half-Heusler (dhH) compounds have recently gained attention due to their compositional flexibility, allowing microstructural tuning for improved performance. The efficiency of a thermoelectric material (zT) improves when the Seebeck coefficient and electrical conductivity increase, while its thermal conductivity decreases.

In this study, Ti2FeNiSb2 was synthesized, and partial substitution of titanium with vanadium and zirconium Ti2-x-yVxZryFeNiSb2, x, y = 0.1, 0.2, 0,3) was performed. The co-doping strategy was deliberately chosen to combine vanadium's ability to raise carrier concentration with zirconium's tendency to distort the lattice and scatter phonons—creating a synergistic effect not achievable through single-element substitution.

Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray Spectroscopy (EDX) revealed critical microstructural changes. Grain size varied systematically with dopant type and concentration, and secondary phases appeared especially in Zr-rich samples at higher levels. While X-Ray Diffraction (XRD) patterns showed little variation across dopants, SEM and EDX exposed inhomogeneities and Zr-rich segregations that acted as phonon-scattering centers, explaining the reduction in thermal conductivity. Vanadium incorporated more uniformly, supporting higher electrical conductivity, whereas zirconium introduced structural distortions that suppressed heat conduction.

As a result, the undoped sample showed a zT of 0.07, while the 0.3V, 0.3Zr co-doped sample reached 0.37 that is a 500 % enhancement. These findings highlight the crucial importance of detailed SEM and EDX analyses in identifying the microstructural sources of performance, showing how microscopy-based insights can inform the development of thermoelectric materials.

Keywords: Thermoelectric materials, Half Heusler, Doping, SEM, Energy

PP-41 - Main Topics in Biological Sciences - Nanotechnology and Applications

The Effect of Polymer Type on the Morphology of Metformin HCl Loaded Spray Dried Micro- and Nanoparticles

Kadir Aykaç, Müzeyyen Demirel

Department of Pharmaceutical Technology, Anadolu University, Eskişehir, Türkiye

AIM: Metformin HCl (MH), a widely used antihyperglycemic drug, has limitations, including poor bioavailability. Micro/nano-particles (MNPs), can overcome these limitations. The aim of this study was to formulate and evaluate of metformin loaded MNPs [1].

MATERIALS-METHODS: Cyclodextrins, polyanhydride, Eudragit® FS 100 (EF) were used to form MH MNPs through spray drying. MH and polymer were dissolved in distilled water and spray-dried in same conditions (Table 1). The morphological characteristics of the MNPs were evaluated using SEM (Zeiss, Supratm 50 VP) at 3 kV [2].

RESULTS: The cyclodextrin MNPs presented amorphous surface with shrunken spherical shape (Fig. 1). Polyanhydride and EF particles show large and small spherical morphology with a very smoother surface. EF MNPs were spherical with a smooth surface and had internal dents and small vacuoles. The polyanhydride MNPs present irregular, shrunken shape and empty interiors [3].

CONCLUSION: The results of SEM were illustrated the differences between MNPs. Particle shape is determined by the atomization, drying, and material composition. Polyanhydride and EF MNPs together were best spherical and smoother surface.

Acknowledgements: We thank, Anadolu University, Plant, Drug and Scientific Resarch Center (AUBİBAM) for SEM analyses.

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Keywords: metformin particles, cyclodextrin, polyanhydride,

Figure 1. MH loaded micro- and nanoparticle SEM images, (A) cyclodextrin contain, (B) polyanhydride and Eudragit® FS 100 together contain, (C) Eudragit® FS 100 contain, (D) polyanhydride contain.

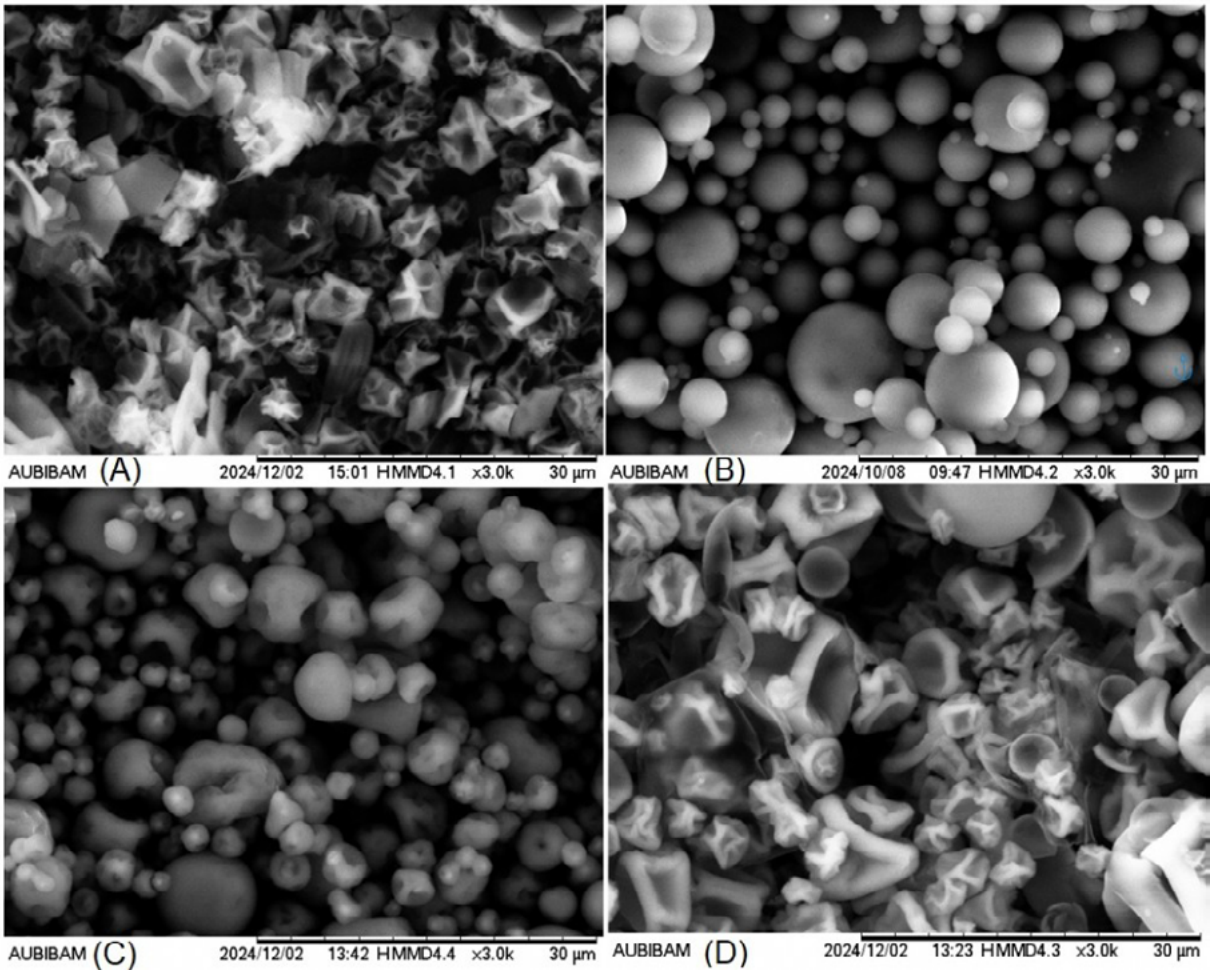

Table 1. Conditions of spray dryer

Inlet temperature	80±20 °C
Outlet temperature	200±20°C
Aspirator	%100
Flow rate	100 ml/h

PP-38 - Main Topics in Biological Sciences - Nanotechnology and Applications

Development of a norfloxacin loaded ocular nanoparticle formulation

İclal Özdemir, Kadir Aykaç, Ebru Başaran

Department of Pharmaceutical Technology, Anadolu University, Eskişehir, Türkiye

AIM: Norfloxacin (NFX) is an effective and safe fluoroquinolone antibiotic for the treatment of ocular infections. However, its low water solubility and difficulties in ocular drug administration limit its bioavailability [1]. In this study, preliminary formulation studies of norfloxacin-loaded polymeric nanoparticles (NP) were conducted to increase its bioavailability for ophthalmic use.

MATERIALS-METHODS: Norfloxacin (NFX) and Polycaprolactone (PCL) were purchased from Sigma (Germany). Eudragit® RS 100 (ERS) was purchased from Röhm Pharma Polymers (Germany). All other reagents used were of analytical grade. NPs were prepared by spray drying at inlet and outlet temperatures of 60±1°C and 40±5°C, respectively [2]. Their in vitro properties were then evaluated. The morphology and surface characteristics of the NPs were analyzed by scanning electron microscopy (SEM) (Hitachi, SPC-900-C SEM, China) at a room temperature of 25°C±2°C. The amount of NFX was determined using a modified HPLC method. In vitro release studies were carried out for 48h with STF at pH7.4 in a dialysis membrane (MWCO=14kDa) (n=3).

RESULTS: Different amounts of NFX were used in the formulation process to highest incorporation efficiency (Table 1). The NPs were characterized in terms of particle size, zeta potential, DSC, FTIR and ^{1}H-NMR analyses. The results confirmed that NFX was effectively integrated into NPs. Furthermore, SEM imaging revealed that the NPs possessed a spherical morphology, suitable for ocular application (Figure 1). The NPs exhibited a more sustained release compared to pure NFX.

CONCLUSION: In vitro studies confirmed the successful preparation of NFX loaded polymeric NPs by spray drying. Their amorphous structure enabled colloidal dispersion in artificial tear fluid, addressing NFX's solubility issue.

Keywords: norfloxacin, ocular drug delivery systems, spray dried nanoparticles

Figure 1. SEM images of NFX, physical mixtures and NPs

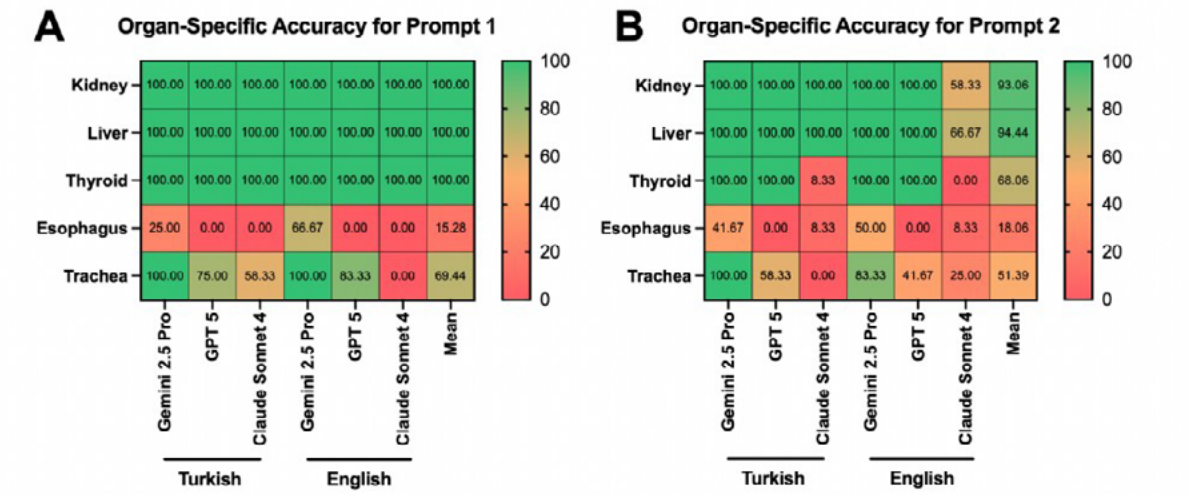

Table 1. Composition of the prepared NP formulations

Code	NFX (mg)	ERS:PCL (3:1; w/w) (mg)	Acetone (mL)
NEP0	-	1000	100
NEP1	50	1000	100
NEP2	100	1000	100
NEP3	150	1000	100

PP-44 - Main Topics in Microscopy Techniques - Advanced Microscopy Techniques

Semi-correlation analysis using cryogenic Scanning Electron Microscopy and Raman microspectroscopy

Kamila Hrubanova[1], Tomas Laznicka[1], Martin Kizovsky[1], Jan Jezek[1], Katerina Mrazova[1], Stanislav Obruca[2], Ota Samek[1], Vladislav Krzyzanek[1]

[1]Institute of Scientific Instruments of the CAS, Brno, Czech Republic

[2]Faculty of Chemistry, BrnoUniversity of Technology, Brno, Czech Republic

Correlative imaging, which integrates multiple observational techniques, is increasingly valuable for comprehensive sample analysis, as it connects complementary datasets that are otherwise obtainable only through separate methods. In this study, we combined cryogenic Scanning Electron Microscopy (cryo-SEM) with cryogenic Raman microspectroscopy. Together, these methods provide both structural and chemical insights.

Cryo-SEM offers detailed information on surface morphology and structure, while cryogenic Raman microspectroscopy excels at identifying chemical composition. To effectively integrate these techniques, we developed a custom assembly compatible with commercial cryo-SEM sample holders. This setup enables precise sample positioning and imaging under cryogenic conditions using liquid nitrogen. We validated the assembly's performance by analyzing frozen bacterial samples.

We focused on Cupriavidus necator H16, a bacterium known for producing polyhydroxyalkanoates (PHAs)—biodegradable polyesters with potential as sustainable alternatives to conventional plastics. PHAs can be biosynthesized from industrial waste streams, making them a promising solution for reducing plastic pollution.

Our results demonstrate that the combined use of cryo-SEM and cryogenic Raman microspectroscopy is highly effective for studying such microorganisms. This correlative approach enables improved characterization of polymer granules within microbial cells [3], offering valuable insights into their physiology and material production.

This integrated method represents a significant advancement in semi-correlative imaging. It enhances the efficiency and depth of microbial analyses and holds strong potential for future.

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Keywords: Cryo-assembly, Cryogenic Raman microspectroscopy, Cryogenic Scanning Electron Microscopy, Semi-correlative imaging

PP-58

High rates of Blastocystis spp. in both patients and healthy controls: Initial results of an epidemiologic study of parasites from Akyazi, Sakarya, Türkiye

Dilara Çankaya[1], Fatma Cevahir[2], Yasemin Tozoğlu[1], Gökçe Özkan[3], Sona Namvar Kohan[4], Minazer Doğan[4], Özgür Kurt[5], Zühtü Tanıl Kocagöz[1,5,6]

[1]Acibadem Mehmet Ali Aydinlar University, Institute of Health,Department of Microbiology, İstanbul, Türkiye

[2]Sakarya University of Apllied Science, Department of Medical Services and Techniques, Sakarya, Türkiye

[3]Acibadem Mehmet Ali Aydinlar University, School of Medicine, Istanbul, Türkiye

[4]Sakarya University of Applied Sciences, Graduate School, Department of Biomedical Engineering, Sakarya, Türkiye

[5]Acibadem Mehmet Ali Aydinlar University, School of Medicine, Department of Medical Microbiology, Istanbul, Türkiye

[6]Acibadem Mehmet Ali Aydinlar University, Institute of Health , Department of Medical Biotechnology, Istanbul, Türkiye

AIM: Parasitic infections are serious but underestimated public health problems in many regions of the world. Epidemiologic studies are important tools both to establish the present infection to local people and encourage health professionals to take measures against them. Here, we present the initial results of the first epidemiologic study on intestinal parasites in both patients and healthy controls from Akyazi in Sakarya province in western Anatolia.

MATERIALS-METHODS: Ethical approval was received from Acibadem University and informed consent was received from all participants prior to enrollment. An inquiry form with questions of both personal and environmental features were filled in by each participant. Stool samples received both from individuals who were admitted to Akyazi State Hospital with gastrointestinal and/or dermatological complaints (Study Group [SG]) and submitted stool for parasitological examination and from healthy volunteers (Control Group [CG])were directly divided into two: one portion were directly taken to -80C for further molecular assessment while the other were directly added in Feconomics®(Salubris, Istanbul) containing SAF (Sodium acetate, acetic acid, formalin) fixative. As of 1st September, 318 stool samples were collected (252 patients, 66 controls) in Akyazi and (started to be) assessed for intestinal parasites in Acibadem University Research Laboratory with direct examination, concentration, trichrome and Kinyoun acid-fast staining.

RESULTS: Initial results indicate that more than half of both groups (SG: 54.8%; CG: 54.5%) had no parasites nor any suspected subjects requiring further assessment. The leading parasite was Blastocystis spp. in not only the SG (n= 95 [37.7%]) but also in health controls (n=23 [34.8%]). Amoeba cysts were detected in 39 patients (15.5%), which require further testing for E. histolytica/E. dispardifferentiation.

CONCLUSION: High frequency of Blastocystis spp. in CG is a striking initial finding, which is consistent with latest reports of Blastocystis indicating its membership of healthy gut microbiota.

Keywords: Blastocystis, Parasitic infections, parasites

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