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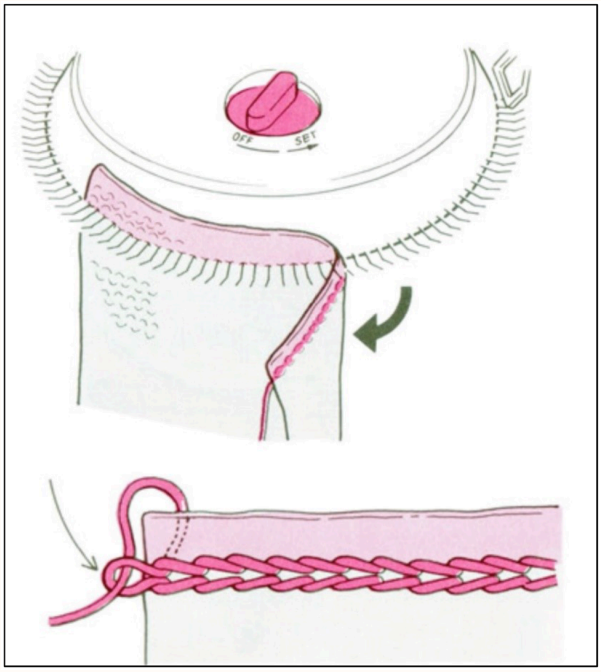
Research Bulletin

September 2025 Publications

THE IMPACT OF SEAMS ON COMFORT IN KNITTED GARMENTS WAS INVESTIGATED

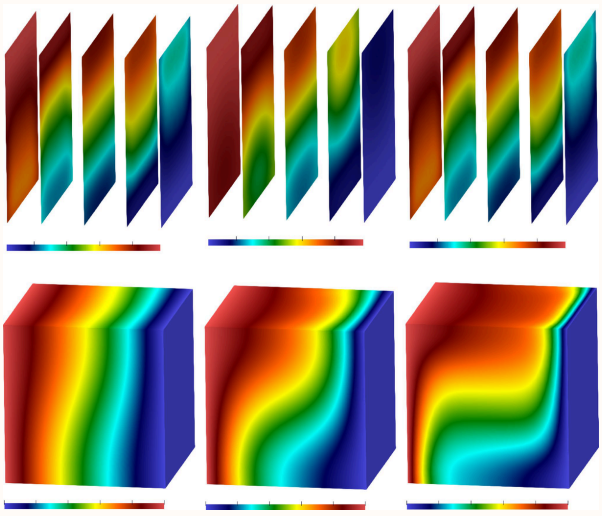


The effect of seams in knitted garments on user comfort was examined. Using common materials such as cotton and merino wool, the study found that garments with seams showed lower friction compared to seamless designs. Removing the seams increases the fabric's contact area with the skin, leading to a higher perception of friction. These findings provide valuable insights for knitted garment designers and manufacturers to enhance comfort and to explore sustainable production options that reduce waste.

12 SORUMLU ÜRETİM VE TÜKETİM

Temel, M., Scott, E., Cain, R., & Johnson, A. A. (2025). The impact of knitted linked seams on comfort and friction perception. *Ergonomics*, 68(8), 1222–1238. https://doi.org/10.1080/00140139.2024.2396516

NEW METHOD PROVES SUCCESSFUL IN HEAT TRANSFER SIMULATIONS



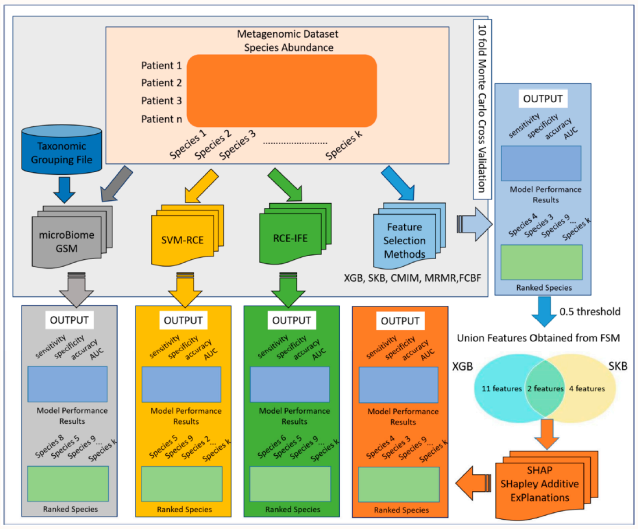
Natural convection heat transfer, which is critical for engineering applications, was investigated using nanofluids. To accurately and efficiently simulate these complex flows, the stabilized finite element method (SUPS) was applied. The simulations revealed that increasing the nanoparticle volume fraction enhanced fluid velocities and the overall heat transfer rate. This new approach offers a cost-effective and reliable tool for improving heat management in areas such as nuclear reactor cooling systems and solar energy technologies.

Cengizci, S., Öztop, H. F., & Atay, M. T. (2025). SUPS-based computational investigation of heat transfer in a nanofluid-filled cubic enclosure with a spherical obstacle. *Journal of Thermal Analysis and Calorimetry*. https://doi.org/10.1007/s10973-025-14702-x

9 SANAYİ, YENİLİKÇİLİK VE ALTYAPI
7 ERİŞİLEBİLİR VE TEMİZ ENERJİ

AUTISM BIOMARKERS DISCOVERED WITH A NEW ARTIFICIAL INTELLIGENCE METHOD

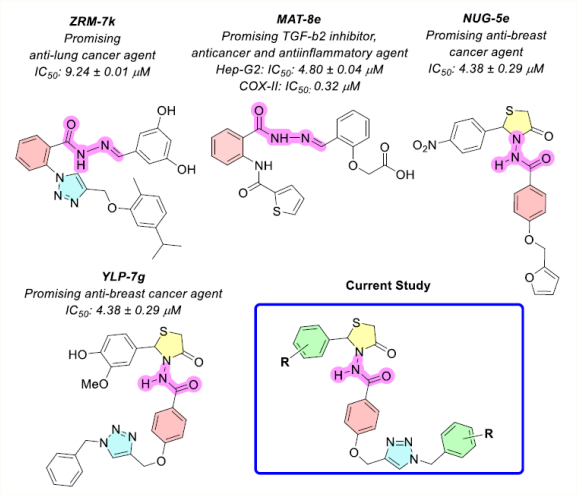
To support the diagnosis of autism spectrum disorder (ASD), metagenomic data (gut microbiota) were analyzed using a newly developed artificial intelligence (AI) model. By applying an AdaBoost classifier together with an innovative combined feature set, the study achieved a remarkably high accuracy (AUC = 0.99). Moreover, through the use of SHAP analysis, the microorganism Prevotella sp. 109 was identified as the most significant biomarker for ASD development. These findings present a promising potential for the development of non-invasive diagnostic kits.



Temiz, M., Bakir-Güngör, B., Ersöz, N. Ş., & Yousef, M. (2025). Machine learning-based prediction of autism spectrum disorder and discovery of related metagenomic biomarkers with explainable AI. *Applied Sciences (Switzerland)*, 15(16), Article 9214. https://doi.org/10.3390/app15169214

NEW HYBRID COMPOUNDS SHOW PROMISE IN TREATING INFLAMMATION

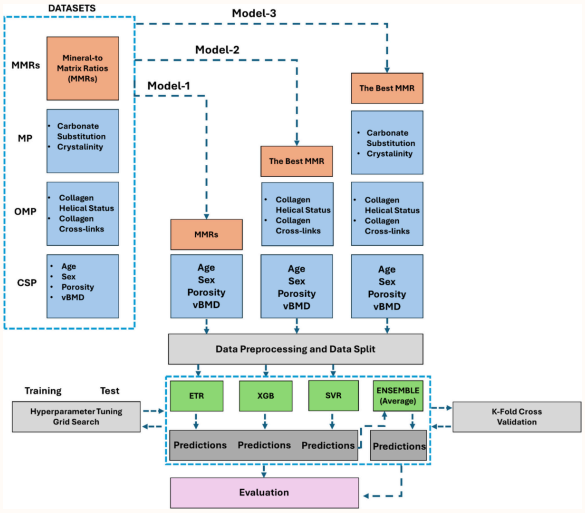
Scientists have developed new hybrid compounds that can halt inflammation in the body. Among the five compounds tested in laboratory studies, compounds 10 and 11 produced the most promising results. Compound 10 was the most effective at reducing the production of harmful proteins such as TNF-α and IL-1β, which drive inflammation. Compound 11, on the other hand, demonstrated the strongest and most sustained binding to TNF-α and the enzyme iNOS, both closely linked to inflammatory processes. In addition, compounds 7, 9, and 10 were found to accelerate wound healing in cells. These encouraging findings highlight the potential of these compounds to serve as the basis for new drugs aimed at treating chronic inflammatory diseases.



Pepe, N. A., Çakır, F., Atalay, T., Acar, B., Turgut, G. Ç., Şen, A., & Şenol, H. (2025). Synthesis, characterization, and comprehensive in vitro and in silico evaluation of the anti-inflammatory potential of novel 1,2,3-triazole–arylidenehydrazide/thiazolidinone hybrids. Archiv der Pharmazie, 358(9), Article e70081. https://doi.org/10.1002/ardp.70081

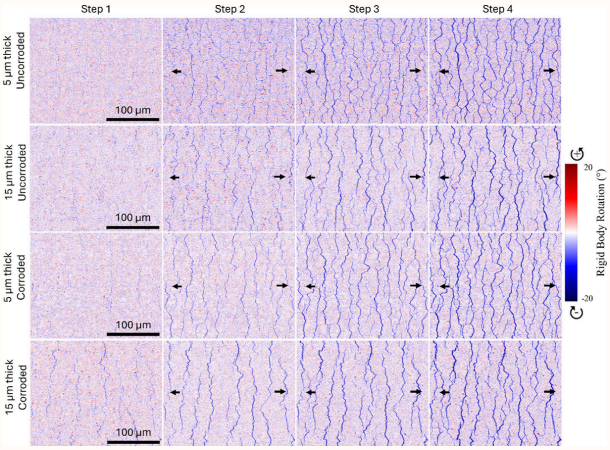
ARTIFICIAL INTELLIGENCE ENABLES EARLY DETECTION OF BONE FRACTURE RISK

A novel approach has been developed that combines Raman spectroscopy (RS) with machine learning (ML) to predict bone fracture toughness in humans. Traditionally considered impossible, this prediction was achieved by integrating chemical data from RS with clinical factors such as age and sex into ML models. Ensemble models successfully predicted crack initiation toughness with 62.3% accuracy, while the XGB (Extreme Gradient Boosting) model achieved 73.7% accuracy in predicting overall energy absorption. This breakthrough demonstrates the potential of artificial intelligence to advance bone research and improve fracture risk assessment.



Ünal, M., Ünlü, R., Uppuganti, S., & Nyman, J. S. (2025). Prediction of biomechanical properties of ex vivo human femoral cortical bone using Raman spectroscopy and machine learning algorithms. *Bone Reports*, 26, Article 101870. https://doi.org/10.1016/j.bonr.2025.101870

CRITICAL COATING ANALYSIS FOR BIODEGRADABLE MAGNESIUM IMPLANTS

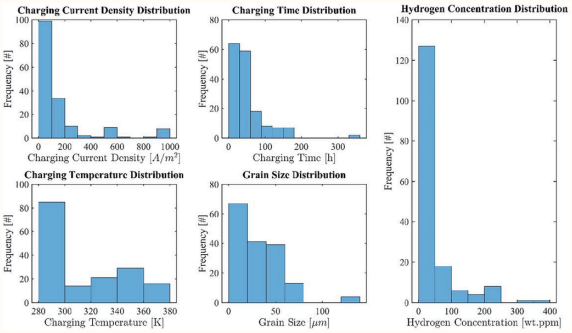


To address the corrosion challenges of biodegradable magnesium alloys (AZ31), which hold promise for biomedical applications, the integrity of protective coatings was investigated. The coated alloys were subjected to mechanical loading, and crack formation was examined. The study revealed that cracks in the coating propagated through its full thickness, reaching the underlying alloy and serving as initiation sites for corrosion. These findings highlight the importance of testing magnesium implant coatings under physiological loading conditions to ensure their reliability and performance.

Yavuzyegit, B., Karali, K., Davis, S., Morrison, B., Karabal, S., Balandiz, K., Smith, N., Usov, S., Shashkov, P., Bonithon, R., & Blunn, G. (2025). High-resolution DIC analysis of in situ strain and crack propagation in coated AZ31 magnesium alloys under mechanical loading. *Journal of Materials Science*, 60(33), 14708–14730. https://doi.org/10.1007/s10853-025-11243-4

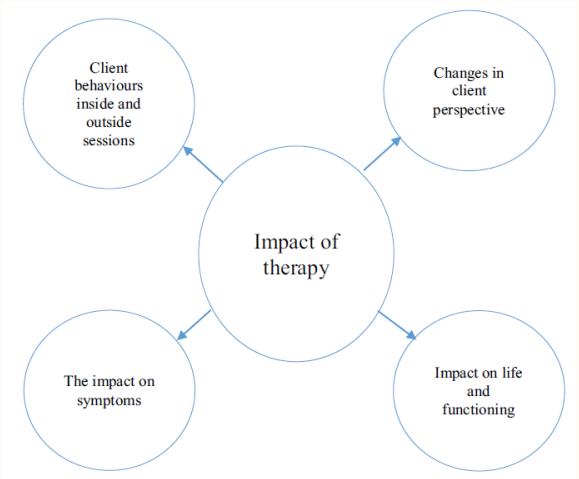
ARTIFICIAL INTELLIGENCE ENHANCES METAL SAFETY: PREDICTING HYDROGEN EMBRITTLEMENT

A new artificial intelligence (AI) model has been developed to accurately predict diffusible hydrogen concentration, a key factor in the risk of catastrophic hydrogen embrittlement in metals. Designed for the face-centered cubic (FCC) family of metals, the model achieved 89% accuracy (R^2) using only four inputs: electrochemical charging conditions and grain size among them. This simple yet reliable predictive capability holds strong potential to simplify safety analyses in industrial designs that rely on high-strength metals.



Sivesoglu, A., Li, Y., & Bal, B. (2025). Prediction of the diffusible hydrogen concentration after electrochemical charging utilizing artificial intelligence. *Materials Research Express*, 12(9), Article 096507. https://doi.org/10.1088/2053-1591/adf1dd

BEHAVIORAL ACTIVATION OFFERS A NEW APPROACH TO TREATING BIPOLAR DEPRESSION

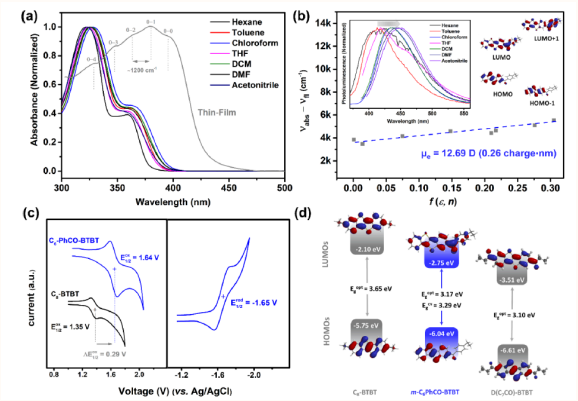


Previously studied only in unipolar depression, behavioral activation (BA) therapy was evaluated in a study involving patients with bipolar depression. Qualitative interviews on the effects of the therapy revealed that participants' experiences aligned with the principles of behavioral theory. Patients emphasized that greater acceptance of themselves and of fluctuations in their mood played a key role in facilitating behavioral change. These findings may contribute to the development of more effective therapy protocols for bipolar depression.

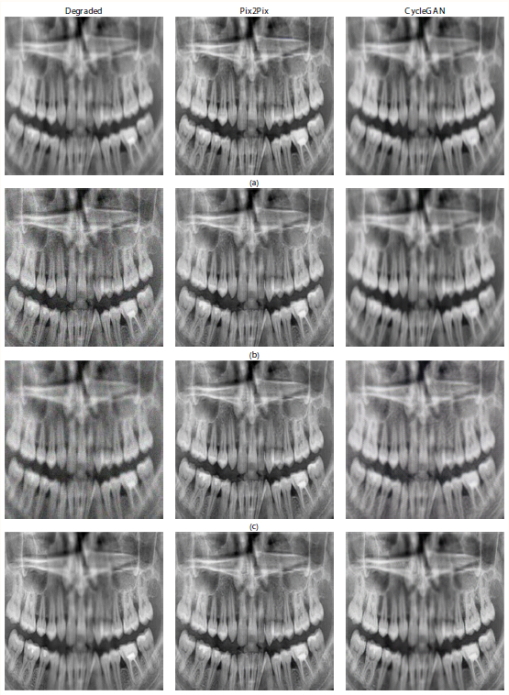
Yılmaz, S., Hancox, A., Price, M., Regan, J., Dunn, B., O'Mahen, H., & Wright, K. (2025). Patient experiences of behavioural therapy for bipolar depression: A qualitative study. *British Journal of Clinical Psychology*, 64(3), 553–568. https://doi.org/10.1111/bjc.12515

ECO-FRIENDLY PRODUCTION METHOD DEVELOPED FOR ELECTRONIC COMPONENTS

A new chemical method has been discovered for processing organic semiconductors using environmentally friendly (green) solvents. Researchers synthesized a novel compound, m-C_6PhCO-BTBT, on a gram scale through a simple, metal-free two-step process. This compound achieved the highest reported solubility for high-performance organic semiconductors to date (176.0 mg mL^{-1}). Organic field-effect transistors (OFETs) produced with green solvents such as acetone and ethanol demonstrated high mobilities of up to 1.87 $cm^2/V{\cdot}s$. This achievement could mark the beginning of a new era in the sustainable production of electronic devices.



Yıldız, T. A., Deneme, İ., & Usta, H. (2025). Achieving extreme solubility and green solvent-processed organic field-effect transistors: A viable asymmetric functionalization of [1]benzothieno[3,2-b][1]benzothiophenes. *ACS Applied Materials & Interfaces*, 17(35), 49720–49736. https://doi.org/10.1021/acsami.5c12618



PANORAMIC X-RAY IMAGES ENHANCED WITH ARTIFICIAL INTELLIGENCE

A study was conducted to improve the diagnostic quality of panoramic X-ray films, which are widely used to visualize dental and jaw structures. To address common distortions such as blurring and noise, three different Generative Adversarial Network (GAN) models were comparatively evaluated. The assessment demonstrated that these AI models have strong potential to correct image distortions and significantly enhance diagnostic quality.

Kolukisa, B., Çelebi, F., Ersu, N., Yücel, K. S., & Murat Canger, E. (2025). Enhancing diagnostic quality in panoramic radiography: A comparative evaluation of GAN models for image restoration. *Concurrency and Computation: Practice and Experience*, 37(23-24), Article e70289. https://doi.org/10.1002/cpe.70289

DEVELOPING A SYSTEM ON THE EXPLORATION OF RELATIONSHIPS BETWEEN BIOMEDICAL ASSETS THROUGH BIOMEDICAL ARTICLES

Digitalization is transforming academic research, particularly in the study of diseases, by enabling the analysis of vast amounts of digital data. This advancement allows researchers to identify important biomedical connections through text analysis and network structures, accelerating the manual search process for known entities and potentially uncovering new relationships. The integration of graph analysis, knowledge discovery, and text mining plays a critical role in revealing key insights in biomedical research, highlighting the impact of digitalization on scientific progress.

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Graduate School of Engineering and Sciences / Electrical and Computer Engineering
MSc. Thesis (2025)

CHARACTERIZATION OF A DISEASE GENE

Research on ciliopathies has revealed the critical role of the EFCAB7 protein, which affects cilia function and structure in rare diseases. Mutations in EFCAB7 were found to shorten cilia and potentially impair neuronal or muscle function, expanding our understanding of its role in maintaining cellular integrity. This study not only suggests new avenues for the treatment of ciliopathies and related disorders but also underscores the importance of continuing to investigate the broader impacts of rare diseases on human health.

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MSc. Thesis (2025)

PLANT-MEDIATED SUSTAINABLE NANOMATERIALS FOR BIOMEDICAL AND OPTICAL APPLICATIONS

Researchers have produced paper-based color converters for solid-state lighting using Peganum harmala extract and synthesized zinc oxide nanoparticles (ZnO NPs) from Hypericum perforatum for liver cancer treatment. These advances highlight the potential of plant-mediated nanomaterials in biomedical and optical applications, offering eco-friendly and low-cost alternatives. ZnO NPs demonstrated significant anticancer effects, while the color converter exhibited high quantum efficiency, marking a step toward sustainable technologies in both scientific research and practical applications.

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MSc. Thesis (2025)

DETERMINATION AND ANALYSIS OF CHARACTERISTICS OF DYSPHAGIA DISEASE FROM EEG SIGNALS

A study investigating the use of EEG data in dysphagia rehabilitation highlights how neurophysiological analysis of swallowing and motor imagery can support therapy. Conducted with 30 participants, the research employed techniques such as ICA, EMD, and CSP, along with machine learning methods like CNN, to improve data analysis accuracy.
The results underscore EEG's potential to distinguish between motor imagery and resting states, offering new avenues for dysphagia treatment and motor rehabilitation. This work emphasizes how EEG-based technologies and advanced analytics could transform clinical applications for swallowing disorders.

Sevgi GÖKÇE ASLAN
Graduate School of Engineering and Sciences / Electrical and Computer Engineering
Ph.D. (2025)

FABRICATION AND CHARACTERIZATION OF HEMOSTATIC CHITOSAN/GELATIN CRYOGEL CONTAINING VERBASCUM THAPSUS EXTRACT AND INVESTIGATION OF HEMOSTATIC EFFECT

A new study introduces chitosan/gelatin hemostatic cryogels enhanced with Verbascum thapsus, targeting hemorrhage—a leading cause of trauma-related deaths. Due to their unique porosity and rapid absorption, these cryogels accelerate clot formation and reduce coagulation time. Demonstrating improved hemostatic activity, antibacterial properties, and compatibility with human cells, this innovation represents a significant advancement in emergency medical care, offering effective control of severe bleeding with life-saving potential.

Hacernur UZUNER
Graduate School of Engineering and Sciences / Bioengineering
MSc. Thesis (2025)

A REVIEW OF DIGITALLY MANUFACTURED EARTHEN STRUCTURES WITHIN THE CONTEXT OF CONSTRUCTION 4.0

The integration of digital and robotic technologies with earth-based materials is set to transform the construction sector. In alignment with Construction 4.0 and sustainability goals, this approach offers low-carbon, efficient alternatives that promise to overcome the challenges of conventional building practices in urban settings. This thesis explores the evolution from traditional construction methods to digital techniques, with a focus on improvements in sustainability and efficiency. It aims to expand the application of earthen materials within the construction industry.

İsmet SAYIN
Graduate School of Engineering and Sciences / Architecture
MSc. Thesis (2025)