ABSTRACTS

Morphing Unmanned Aerial Systems UAS-S4 and UAS-S45 Performance Methodologies

Ruxandra Mihaela Botez, Full Professor, PhD, Eng., FAIAA, FRAeS, FCAE, FCASI

École de technologie supérieure, 1100 Notre Dame Ouest, Montréal, Que, Canada, H3C-1K3

Abstract

In this abstract, we present research done at our Laboratory of Active Controls, Avionics and AeroServoElasticity LARCASE at the École de technologie supérieure in University of Quebec in Montreal, Canada in the areas of Morphing Unmanned Aerial Systems Technologies.

Our LARCASE laboratory is equipped with two Unmanned Aerial Systems UAS-S4 and UAS-S45 from the Mexican company Hydra Technologies, two Level D flight simulators for the Cessna Citation X business aircraft and for the commercial regional jet CRJ-700 from CAE Inc., Cessna and Bombardier companies, and the Subsonic Blowdown Price-Païdoussis Wind Tunnel from McGill University.

Some of these equipment, more precisely, the UAS-S4, UAS-S45 and the subsonic blowdown wind tunnel, are used in our research realized for morphing unmanned aerial systems with the aim to improve their aerodynamic performances, expressed in terms of drag reduction, lift, lift-to-drag ratio and rate of climb increased, delay of the flow transition from laminar to turbulent regime, stall delay, fuel consumption reduction and many other benefits.

An overview of methodologies and results for the Morphing UAS-S4 and UAS-S45 Aerodynamic and Structural Analysis, and various types of Morphing Wing Design, Manufacturing and Testing at the Price-Païdoussis Subsonic Wind Tunnel expressed in terms of Morphing Leading Edge and Trailing Edge designs will be presented in details, including their benefits for aerodynamic performance increase.

Keywords: Morphing Leading Edge, Morphing Trailing Edge, Morphing Camber System, Aerodynamics, Structural Design, Controls, UAS-S4, UAS-S45.

Structural Principles of Scientific Network Formation: A New AI-Powered Collaboration Tool for the Romanian - American Scientific Community

Gabriel Gruionu[1,2]
[1]DRG Innovation LLC | Indiana University School of Medicine, U.S.A.
[2]American Romanian Academy of Arts and Sciences

Romanian - American scientific organizations sustain a productive community through annual conferences and informal exchanges, yet these interactions rarely mature into the funded, publication-generating, project-based collaborations that define durable scientific partnerships. The structural gap between acquaintance and collaboration has resisted decades of well-intentioned networking.

Research in microvascular biology offers a mechanistic framework for understanding why. Functional vascular networks emerge not from random contact, but through phenotype matching between structurally compatible fragments, selective resource allocation, and — most critically — the presence of a shared morphogenic task that compels independent units into coordinated action. It is proposed that scientific collaboration networks are governed by analogous principles, and that their failure to consolidate within existing Romanian - American organizations reflects the absence of precisely these conditions: compatibility mapping, resource alignment, and a common project as organizational nucleus.

Over three decades of transatlantic research, more than 90 scientists, clinicians, and engineers across more than 15 institutions in the United States, Romania, Norway, Denmark, France, and Ireland have been engaged in collaborative work — in each case anchored by a shared scientific problem rather than shared origin.

Drawing on this experience, a tool has been developed to operationalize these biological principles at the scale of a professional network — one capable of identifying non-obvious compatibilities across disciplines, career stages, and institutions, and of surfacing concrete collaborative projects from the latent structure of a community's collective expertise — with the potential to fundamentally accelerate the pace at which scientific communities move from introduction to meaningful, sustained collaboration.

The Exhibition "Andrei Șerban, George Banu, Basarab Nicolescu – Friendship beyond time and space"

Curators: Lucian Dindirică, Radu Vințeanu
Museum of the Romanian Book and Exile

The exhibition Andrei Șerban, George Banu, Basarab Nicolescu – Friendship Beyond Time and Space highlights a documentary corpus illustrating the intellectual and personal relationships among three major figures of Romanian cultural exile in the second half of the twentieth century.

Based on materials from the archives of academician Basarab Nicolescu, Andrei Șerban and George Banu from the collections of the Museum of the Romanian Book and Exile, the exhibition reconstructs what may be described as the archive of a transnational intellectual friendship, developed over decades between Paris, New York, Vienna, and Bucharest.

Andrei Șerban, one of the most important contemporary Romanian theatre directors, George Banu, a renowned theatre critic and theorist, and Basarab Nicolescu, physicist, philosopher of science, and founder of transdisciplinarity, were united by a profound intellectual and human affinity. Their lives abroad did not represent a separation from Romanian culture; rather, they continued to engage with it through artistic creation, critical reflection, and intellectual activity carried out in the Western cultural sphere.

The core of the exhibition consists of correspondence exchanged among the three protagonists, including letters and postcards that reveal not only the personal dimension of their friendship but also their exchange of ideas, collaborative cultural projects, and shared concerns. These documents are complemented by archival photographs, significant publications connected to their relationship, and other documentary materials illustrating the continuity of a dialogue sustained through culture, friendship, and intellectual exchange.

A special place within the exhibition is occupied by the volume Andrei Șerban. A Biography, in which Basarab Nicolescu describes the director as a "perpetual seeker of Truth." This characterization reflects not only Șerban's artistic personality but also the values that united the three intellectuals: the search for meaning, freedom of spirit, and openness to dialogue across disciplines and fields of knowledge.

Through the documents on display, the exhibition highlights the importance of personal archives in preserving cultural memory and in researching the recent history of Romanian exile. Beyond commemorating remarkable individual destinies, it offers insight into an intellectual network that contributed to the international dissemination of Romanian cultural values and demonstrates how friendship, dialogue, and the exchange of ideas can transcend the boundaries of time and space.

70 years of Romania in UNESCO – Past Lessons, Future Horizons

Part II: Roundtable Discussion

An interactive discussion gathering diplomats, scholars, cultural professionals, and specialists in international relations. This session will reflect on lessons learned from Romania's UNESCO legacy and consider new directions for strengthening Romania's role in multilateral diplomacy.

Moderator: Gabriela GABOR, Codrin TĂUT
Panel members: Adrian Tudor, Alexandru Andrasanu, Andrei Luca, Ioana Dragan, Lucian Jora, Madalina Iacob

In the context of the 70th anniversary of Romania's accession to UNESCO, the American Romanian Academy of Arts and Sciences (ARA) and the Romanian National Commission for UNESCO will organize, on June 30, 2026, a thematic panel dedicated both to reflecting on this shared history and to exploring future perspectives for cooperation. The panel will be held within the framework of the 47th Congress of the American Romanian Academy of Arts and Sciences, taking place on June 30 – July 1, 2026, at the Transilvania University of Brașov, Romania. Organized by ARA in collaboration with Transilvania University of Brașov, the 2026 ARA Congress provides an important setting for intellectual exchange across disciplines and institutions. The event will bring together representatives of the academic community, practitioners, and institutional stakeholders for a dialogue on Romania's longstanding engagement with UNESCO's values and programs. The discussions will highlight key moments in this seventy-year relationship, while also addressing the challenges and opportunities that lie ahead in areas such as education, culture, science, and international intellectual cooperation. By creating a space for exchange between scholars and professionals, the panel aims to reaffirm the relevance of UNESCO's mission in today's world and to encourage renewed forms of collaboration capable of responding to contemporary global and regional realities.

Bioactive Copper(II) Complexes and Their Potential Involvement in the Treatment of Coppe Deficiency-Related Diseases

Mircea Alexandru Mateescu[1,2,*], Mariela Gomez Perez[1], Ispas-Szabo Pompilia[1], Marius Andruh[2], Borhane Annabi[1]

[1]Department of Chemistry, Faculty of Science, CERMO-FC Centre, Université du Québec à Montréal, Montréal (QC) H3C 3P8, Canada, *mateescu.m-alexandru@uqam.ca*

[2]Romanian Academy, 125, Calea Victoriei, RO - 010071, Bucharest, Romania

Impaired cellular copper uptake is a principal etiologic determinant in various severe inherited disorders, including Menkes disease and hypertrophic cardio-encephalomyopathy. In this context, a series of Cu(II) coordination complexes were recently synthesized using small ligands as L-histidine, L-serine, urea, and biuret [1]. The complexes were prepared by reacting the corresponding ligands with $CuCl_2$, followed by purification through alcohol precipitation. The novelty of this work was the successful isolation of these compounds in solid state.

Structural and physicochemical characterization by elemental analysis, X-ray diffraction, and FTIR spectroscopy demonstrated that the complexes adopted the general formula $[Cu(ligand)_2]$. Coordination analysis further revealed distinct ligand-binding modes to the copper center: tridentate for L-histidine, bidentate for L-serine and biuret, and monodentate coordination for urea.

The complexes [Cu(His)2Cl2] and [Cu (Ser)2], were stable in physiological media and presented a good potential as therapeutic agents. Their biocompatibility was investigated on intestinal differentiated Caco-2 cells model and their action on the integrity and permeability of cell membranes was evaluated by the transepithelial electrical resistance (TEER) at concentrations up to 100 μM. In parallel, the distribution of the copper complexes was quantified on both apical and basolateral compartments of the cell monolayer. The results suggested a copper paracellular flow. The intracellular copper retention was lower than 2.7%. This is of interest, showing the availability of absorbed Copper (II) to be released in circulation for further therapeutic functions. No differences in intracellular copper content between 6 h and 48 h, indicated an early copper retention process. At the molecular level, both $[Cu(His)_2Cl_2]$ and $[Cu(Ser)_2]$ induced transcriptional downregulation of the four principal copper transporters: CTR1, DMT1, ATP7A and ATP7B, while simultaneously promoting upregulation of metallothionein. Importantly, treatment of cells with these Cu(II) complexes at concentrations of 50-100 μM resulted in a recovery of cytochrome c oxidase: a copper-dependent mitochondrial enzyme with a key role in cellular respiration. Collectively, these findings indicate these complexes as candidates with therapeutic relevance for patients affected by copper deficiency disorders.

Keywords: Medicine, Biochemistry, Rare (Orpheline) diseases, Menkes disease, Hypertrophic cardioencephalomyopathy, Copper complexes, Cytochrome c oxidase, Intestinal Caco-2 cells.

References

[1] Esmaeili, L, Mariela Gomez Perez, M, Jafari, M, Paquin, J, Ispas-Szabo, P, Pop, V, Andruh, M, J Byers, J, Mateescu, M.A, Copper complexes for biomedical applications: Structural insights, antioxidant activity and neuron compatibility. Journal of Inorganic Biochemistry 192 (2019) 87-97

[2] Gomez Perez, M, Gonzalez Suarez, N., Annabi, B, Mateescu, M.A, Bioactive copper(II) agents and their potential involvement in the treatment of copper deficiency-related orphan diseases. Journal of Inorganic Biochemistry 247 (2023) 112334.

Green Polymers Based Membranes as a Solution for Global Water Crisis

Stefan Ioan VOICU
[1] National University of Science and Technology Politehnica Bucharest, Advanced Polymers Materials Group, Str. Gheorghe Polizu 1-7, Bucharest 011061, Romania. *stefan.voicu@upb.ro*
[2] National University of Science and Technology Politehnica Bucharest, Faculty of Chemical Engineering and Biotechnologies, Department of Analytical Chemistry and Environmental Engineering, Str. Gheorghe Polizu 1-7, Bucharest 011061, Romania.
[3] Academy of Romanian Scientists, Str. Ilfov nr. 3, Bucuresti, Romania

Until the end of the nineteenth century, the use of water exactly as it was found in nature was not a problem, mainly due to the minimal impact that humans had on its quality. The main sources of pollution were represented by household or domestic activities, and the only methods used for water purification were sand filtration (used in stations that supplied water to large cities) and distillation (used specially to produce very pure water for the medical and pharmaceutical field). However, the development of cities and industry lead to a constant growth of water pollution and, therefore, the need for fast and effective filtering methods. Therefore, in 1804, Robert Thom designed the first municipal water treatment station in Scotland. The use of polymer membranes for water filtration and purification became a necessity after the Second World War. In Germany, the newly founded the Millipore company, through the Marshall Plan of the United States, transformed huge quantities of nitrocellulose (used as an explosive powder for bomb production) into microfiltration and ultrafiltration membranes. It should be noted that until the appearance of the first water treatment station in 1804, for almost 1 million years of human existence, in the current evolutionary form, a large-scale filtration method to obtain drinking water was not required, and, in the next 150 years, it was necessary to go from sand filtration to polymer membrane filtration through micro and ultrafiltration processes. In another 50 years (from 1950 to 2000), installations with high capacity for microfiltration and desalination with high energy consumption, working pressures and increased material requirements were also needed, due to a drastic decrease in the size of the species to be removed [1]. Over the past three decades, humanity has been facing an unprecedented drinking water crisis. The main causes for this crisis are three in number – population growth (which puts pressure on existing water sources), climate change (which through global warming leads to a reduction in the number of drinking water sources) and pollution (which leads to affecting the quality of existing water sources). One of the main solutions to this crisis is desalination, a process that consists of filtering seawater to produce drinking water. If at the beginning of the process, in 1970, the total installed capacity worldwide was 100,000 cubic meters/day, today it exceeds 100 million cubic meters/day. Desalination, however, is an efficient process if the seawater does not contain additional impurities such as micro oil emulsions, microplastics or other types of pollutants. The main technical solutions that are currently available in the field of polymeric membranes to solve this crisis will be presented, as well as the future prospects for avoiding a major global water crisis.

Keywords: water availability, water crisis, membranes, filtration.

References

Oprea, M.; Voicu, S.I., Cellulose Acetate-Based Materials for Water Treatment in the Context of Circular Economy. Water 15, 1860, 2023.

Advanced APS Coatings for Agricultural Components: From Microstructure and Electrochemistry to Enhanced Mechanical Performance

Bogdan Istrate[1], Corneliu Munteanu[1,2] *, Boris Nazar[3], Iurie Melnic[3]

[1] Mechanical Engineering, Mechatronics and Robotics Department, Mechanical Engineering Faculty, "Gheorghe Asachi" Technical University of Iasi, 700050 Iasi, Romania

[2]Technical Sciences Academy of Romania, 26 Dacia Blvd., 030167 Bucharest, Romania

[3] Mechanical Engineering Faculty, Technical University of Moldova, Bd. Stefan cel Mare 168. L, MD-2004

In the present work, various APS coatings (namely W2C/WC-12%Co (Metco71NS), Cr2O3-4SiO2-3TiO (Metco136F), Co25.5Cr10.5Ni7.5W0.5C (Metco45C-NS) and WC-12%Co (WOKA 3101) deposited by Sulzer Metco 9MCE on disc harrows and reversible plough parts (mainshare and foreshare) exposed to high abrasive and corrosive service conditions were investigated.

SEM/EDS/XRD characterization revealed lamellar splat morphology, controlled porosity and strong substrate adhesion. Thicknesses ranged from tens of microns (Metco136F) to over 200 μm for carbide and alloy systems.

The phase analysis confirmed the presence of WC/W2C, Cr2O3/TiO2 and NiCr intermetallics. The base materials possess ferrite-pearlite and Widmanstätten structures (disc harrow) and microstructures of pearlite (plow parts). Electrochemical tests in simulated soil environments indicated that WC- and Cr2O3-based coatings exhibited excellent corrosion resistance, attributed to their dense microstructures and stable passive oxide layers. The tribological tests (CETR-UMT-2) measured the friction coefficient, Young's modulus, hardness and stiffness. The WC-12%Co coatings showed the highest hardness and lowest friction, while the Co-based alloy showed better ductility and impact tolerance.

The results validate APS as a viable strategy for extension of the service life of agricultural working components, with each coating system providing specific advantages depending on the dominant degradation mechanism.

Keywords: atmospheric plasma spray (APS); disc harrow; plow; WC-Co; Cr_2O_3; microstructure; electrochemistry; tribology; mechanical properties

Electrochemical Approaches to Surface Bioactivation of Metallic Biomaterials

Cosmin M. Cotrut [1*], Diana M. Vrânceanu [1], Elena Poenaru[1]

[1] National University of Science and Technology Politehnica Bucharest, 313 Splaiul Independentei, 060042, Romania, *cosmin.cotrut@upb.ro*

The performance and clinical applicability of biomaterials in the human body are of major importance for the development of biomedical devices and tissue engineering strategies. Ongoing advances in materials science and engineering have enabled the development of a wide range of metallic biomaterials designed to address increasingly complex biomedical demands. Beyond their traditional load-bearing role, metallic biomaterials are currently being tailored to exhibit additional functionalities, including bioactivity, antimicrobial behavior, drug delivery capability, and even antitumor effects [1]. Since the interactions occurring at the biomaterial–tissue interface is strongly governed by surface properties and protein adsorption, surface engineering has become a key approach for improving the biological performance of metallic implants [2]. Biofunctionalization represents an effective strategy for modifying the surface composition, structure, and morphology of a material while preserving its bulk mechanical properties. In this context, both wet- and dry-based surface treatment methods have been developed to enhance the compatibility of metallic biomaterials with hard tissues.

A wide range of surface functionalization approaches have been applied to titanium and its alloys, beginning with mechanical surface treatments and extending to advanced electrochemical methods such as anodic oxidation and electrochemical deposition of hydroxyapatite-based bioactive ceramic coatings. These coatings were investigated either in their undoped form or after incorporation of biologically active ions such as Ag, Zn, Sr, or Mg, with the aim of improving osseointegration [3]. The resulting surfaces were characterized in terms of roughness, wettability, morphology, crystalline structure, corrosion resistance, and bioactivity. The obtained results demonstrated that electrochemical bioactivation is an effective route for tailoring the surface properties of metallic biomaterials toward enhanced biological response and functional performance.

The surface properties of metallic biomaterials can be effectively tailored to meet specific biological requirements through appropriate biofunctionalization strategies. In this regard, electrochemical approaches provide versatile and efficient tools for the design of bioactive implant surfaces with improved biomedical performance.

Keywords: Engineering, electrochemical deposition, hydroxyapatite, biocompatibility, apatite formation

References

Qizhi Chen, George A. Thouas; Metallic implant biomaterials; Materials Science and Engineering: R: Reports; 87 (2015) 1-57

Antoniac I.V.; Handbook of Bioceramics and Biocomposites; 2016, 1386

Ungureanu E, Vranceanu DM, Vladescu A, Parau AC, Tarcolea M, Cotrut CM. Effect of Doping Element and Electrolyte's pH on the Properties of Hydroxyapatite Coatings Obtained by Pulsed Galvanostatic Technique; Coatings; 11(2021) 1522.

Evaluation of the Corrosion Behavior of APS-Coated Steel in Acidic Environments with Controlled H_2S Concentration

Ramona Cimpoeșu[1], Romeu Chelariu[1], Istrate Bogdan[2], Corneliu Munteanu[2], Daniela Lucia Chicet[1], Gheorghe Badarau[1], Nicanor Cimpoeșu[1,*]

[1]Faculty of Materials Science and Engineering, "Gheorghe Asachi" Technical University of Iasi, 41 Dimitrie Mangeron Blvd, 700050 Iasi, Romania, *nicanor.cimpoesu@academic.tuiasi.ro*.

[2]Faculty of Mechanical Engineering, "Gheorghe Asachi" Technical University of Iasi, 43 Dimitrie Mangeron Blvd, 700050 Iasi, Romania.

Ceramic coatings obtained by various methods have recently been successfully used to improve some properties of metallic elements such as: the resistance to corrosion, high temperatures and thermal shocks, and the harmful effects of hydrogen or hydrogen sulphide [1]. Current literature [2] presents a detailed analysis of the main hydrogen permeabilities for state-of-the-art barrier coatings containing different oxides, carbides and nitrides according to the literature, and Cr2O3 coatings are considered as a suitable solution for hydrogen protection [5]. However, no results are reported for composite coatings (ceramic-oxide combinations). This study investigates the corrosion protection performance of multi-layered coatings deposited via Atmospheric Plasma Spraying (APS) on a stainless-steel substrate. The coatings were engineered using varying proportions of Metco 6156 (Ni-based alloy) and Metco 207 (High-Yttria Stabilized Zirconia 20% Y2O3) to create a complex ceramic-metallic structure. Three distinct samples were prepared, each featuring a 6-layer architecture designed to optimize the transition from the metallic substrate to the ceramic-rich top surface. The protective performance against corrosion was evaluated in a 1M Na2SO4 solution acidified to pH 3. A controlled concentration of 20 ppm H2S was generated in situ through the stoichiometric addition of Na2S. To simulate high-pressure industrial conditions and prevent the oxidation of the sulfide species, the system was deaerated with argon at 4-5 bar. Electrochemical testing, including Open Circuit Potential (OCP), potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) was performed at 25C. The results demonstrate that the multi-layered approach and the high yttria content in the Metco 207 phase significantly enhance the chemical stability of the coating. The layered gradient effectively mitigates the mismatch in thermal expansion coefficients and reduces the interconnected porosity, providing a superior barrier against the diffusion of HS- ions compared to traditional monolithic coatings.

Keywords: APS,StainlessSteel, Metco, Multi-layered coatings, corrosion, High-Yttria YSZ.

Acknowledgements: This study is part of a project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101131793, Project CrOYOZO - ID 186.

References

Attarzadeh, N., Molaei, M., Babaei, K., Fattah-alhosseini, A., New Promising Ceramic Coatings for Corrosion and Wear Protection of Steels: A Review, Surfaces and Interfaces, Vol. 23, April 2021, 100997.

Singh, V.P.; Sil, A; Jayaganthan, R. A study of sliding and erosive wear behavior of atmospheric plasma sprayed conventional and nanostructured alumina coatings. Mater Des. 2011, 32, 584−591.

Experimental evaluation of anti-sparking alloys for safer tools used in explosive atmospheres

Costică Bejinariu[1,2], Ramona Cimpoesu[3,*], Gheorghe Bădărău[3], Bogdan Istrate[4], Romeo Gabriel Chelariu[5], Nicanor Cimpoesu[3]

[1]Department of Materials Engineering and Industrial Safety, Technical University Gheorghe Asachi from Iasi, Blv. Mangeron, 700050, Iasi, Romania

[2]Academy of Romanian Scientists, Ilfov 3, 050044 Bucharest, Romania

[3]Department of Materials Science, Technical University Gheorghe Asachi from Iasi, Blv. Mangeron, 700050, Iasi, Romania, *ramona.cimpoesu@academic.tuiasi.ro*

[4]Faculty of Mechanics, Romania, Technical University Gheorghe Asachi from Iasi, Blv. Mangeron, 700050, Iasi, Romania

[5]SC. ProtectMe S.R.L., Romania

This study presents the experimental assessment of two copper-based alloy systems, CuAlBe and CuTi, proposed for the manufacture of anti-sparking tools and safety components with improved functional performance [1]. The investigated alloys were produced by classical casting followed by thermo-mechanical processing and characterized in terms of spark behavior, corrosion resistance, and mechanical properties. Wear tests involving up to 16.000 friction cycles indicated that neither alloy system generated dangerous hot sparks capable of initiating ignition, confirming their suitability for hazardous environments. Both alloy families showed low friction coefficients, around 0.2, favorable for moving mechanical assemblies and hand tools. Mechanical testing revealed higher hardness values for CuAlBe alloys, reaching approximately 2.1 GPa, while CuTi alloys exhibited values near 1.7 GPa but demonstrated significantly higher elastic modulus, recommending them for components requiring greater stiffness and dimensional stability. These complementary behaviors indicate that CuAlBe alloys are advantageous for impact and wear-resistant tools, whereas CuTi alloys are attractive for precision parts and structural elements. Electrochemical corrosion tests in 3.5% NaCl solution showed that both alloy systems formed partially protective surface layers consisting of oxides, chlorides, and salts. Thermo-mechanically processed CuAlBe alloys exhibited a corrosion current reduction of nearly one order of magnitude compared with the as-cast state, while cast CuTi alloys showed superior intrinsic corrosion resistance. The results demonstrate that CuAlBe and CuTi alloys represent viable alternatives to conventional spark-producing steels for the production of safer industrial tools and components.

Keywords: anti-sparking alloys; occupational safety; explosive atmospheres; corrosion; mechanical properties; non-sparking tools; worker protection

Acknowledgement: This work was supported by a grant of the Ministry of Education and Research, CCCDI-UEFISCDI, project number PN-IV-P6-6.1-CoEx-2024-0102 within PNCDI IV

References

Chelariu, R.G.; Cimpoesu, R.; et al. Analysis of Chemical, Microstructural and Mechanical Properties of a CuAlBe Material Regarding Its Role as a Non-Sparking Material. Materials 2024, 17, 2220. https://doi.org/10.3390/ma17102220

Degradation and Biocompatibility Studies on Cellulose-Acetate-Based Composite used as Coatings for Biodegradable Magnesium Implants

Alexandru Streza[1], Aurora Antoniac[1*]
[1]National University of Science and Technology POLITEHNICA Bucharest, Splaiul Independentei 313, sector 6, Bucharest, Romania, alexandru.streza@upb.ro

The main limitation in the implementation of magnesium as an orthopaedic biomaterial is that the degradation occurs before the formation of stable tissue around the implant, so it is necessary to improve the corrosion resistance.

A common method for improving corrosion resistance is element alloying method. And as a degradable implant material, alloying elements must be chosen with careful consideration of the possible systemic effects. Mg dissolves as Mg2+ which reacts with water, generates hydrogen bubbles, creates hydroxyl groups, and increases pH. Micro-bubbles that get larger and float in the air are generated from pitting or active corrosion sites. Dissolved Mg2+ ions react with hydroxyl groups (OH--) and precipitate as Mg (OH)2. Also, a passive interlayer is formed on the degradation surface.

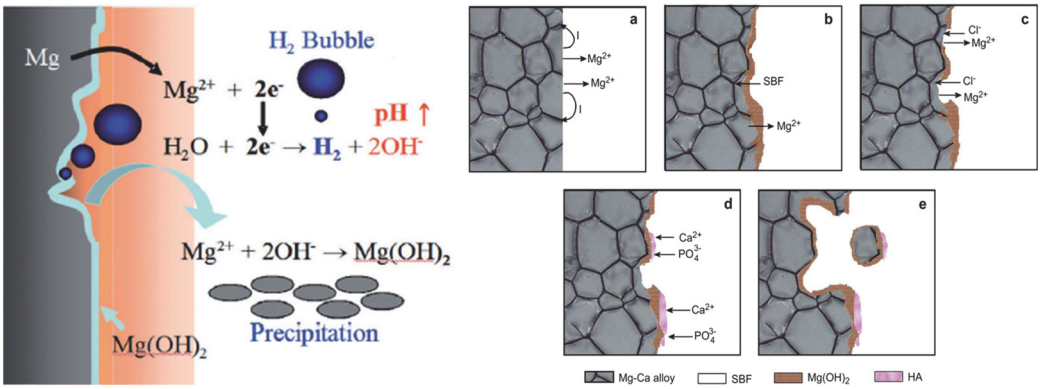


Figure 1. Schematic representation of Mg degradation in human body envinronment

The aim of this study was to develop new composite coatings made of polymeric materials (cellulose acetate) reinforced with Mg and hydroxyapatite, with superior osseointegration potential. Composite coatings for osseointegration were designed to be used at the interface between implants and bone in order to facilitate and improve the integration of implants in bone.

The magnesium alloys are suitable for development the orthopaedic applications like screw for fracture fixation (small implants are recommended). We obtain and characterize different experimental magnesium alloys (Mg-Zn-Zr alloys looks to be very promising alloys).

Keywords: Materials Engineering; Magnesium alloys; Coatings; Corrosion.

Acknowledgement: This work was supported by the grant POCU/993/6/13 -153178, co-financed by the European Social Fund within the Sectorial Operational Program Human Capital

Bioinspired Materials and Antimicrobial Technologies for Healthcare

Julietta V. Rau
Istituto di Struttura della Materia, Consiglio Nazionale delle Ricerche, ISM-CNR,
Rome, Italy, giulietta.rau@ism.cnr.it

Nature has long provided inspiration for the development of advanced materials with unique structural, functional, and biological properties. Today, bioinspired materials and antimicrobial technologies are emerging as key drivers of innovation in healthcare, offering new approaches to address major clinical challenges such as infections, implant failure, and tissue regeneration. By mimicking natural systems and combining multifunctional properties, these materials are contributing to the development of safer, smarter, and more effective biomedical devices and therapies.

This keynote will explore recent advances in bioinspired biomaterials for healthcare applications, with emphasis on antimicrobial and bioactive solutions for orthopaedics, dentistry, and regenerative medicine. Particular attention will be devoted to calcium phosphates, bioactive glasses, nanostructured coatings, and functionalized implant surfaces designed to enhance tissue integration while simultaneously preventing bacterial adhesion and biofilm formation. Such strategies are increasingly important in reducing implant-associated infections and improving long-term clinical outcomes.

The presentation will further discuss how surface engineering, nanotechnology, and biomimetic approaches can be combined to create multifunctional materials capable of actively interacting with biological systems. Emerging developments in antibacterial coatings, biodegradable materials, and advanced diagnostic-related biomaterials will also be highlighted, illustrating the strong interdisciplinary convergence between materials science, nanotechnology, biology, and medicine.

As healthcare increasingly demands personalized, sustainable, and high-performance solutions, bioinspired materials are paving the way toward a new generation of intelligent biomedical technologies. These innovations have the potential not only to improve patient care and implant safety, but also to redefine the future role of materials in modern medicine.

High-Entropy Alloys (HEAs): Microstructural, Mechanical and Thermal Properties of B4C Reinforced Spark Plasma Sintered $CoCrFeNiAl_{0.6}$ HEAs

Gultekin Goller

Istanbul Technical University, Department of Metallurgical and Materials Engineering, 34469, Maslak, Istanbul, Türkiye

High-entropy alloys (HEAs) are promising materials for high-temperature structural applications due to their properties, including high mechanical strength and high-temperature stability.

In this study, a mechanically alloyed CoCrFeNiAl0.6 HEA was reinforced with 2–4 vol.% boron carbide (B4C) and consolidated via spark plasma sintering (SPS) at 1000 °C under a pressure of 40 MPa for 5–6 minutes.

This study aims to investigate the effects of B_4C addition on the microstructural, mechanical, tribological and thermal properties of the alloy.

The alloy structure exhibited both FCC and BCC phases. The hardness value increased from 4.29 GPa to 5.02 GPa. The wear resistance improved up to 80% at room temperature and by 70% at 600 °C as the B4C content increased.

The addition of B4C had a negative effect on high-temperature oxidation resistance.

The findings demonstrate the potential of B4C-reinforced HEAs for high-temperature wear-resistant applications.

The Approaches of Economic Integrated Informatics Systems

Tudor Leahu
Prof., PhD, m. c. ARA, Free International University of Moldova, ORCID 0009-0001-2214-5732, e-mail: leagutudor85@gmail.com

In the present work management of the material activities (fabrication, distribution (commercialization), consumption) system, as a unitary information and material nucleus, that acts automatically, in real time, is analysed in the. In this context we have highlighted the objectives according to which is characterized the current situation of the existent information situation in the material (physics) environment. Based on the results of the analysis of this situation, of the formulated objectives of the prospect of the evolution of in cause systems, have been disclosed the problems of their constitution and daily activities in the functional -informatics plan.

Nowadays, most basic human material processes (fabrication, distribution (commercialization), consumption) and informational (informative, decisional), under a spatial aspect, are separated and function in different periods of time. The galloping progress of the elaboration, production and massive implementation of informatics means and methods, in both spheres of scientific and practice activities, more insistently requires and approach in fulfilling and functioning of information systems that are spatially and temporally integrated in the material management.

Considering the created situation, in the given context and from the afore – mentioned positions, of the major importance are the issues of analysis in the field, as well as highlighting and formulating the objectives and the problems of the constitution of functioning of the material integrated informational systems. Are formulated some concepts of elaboration (projection) and functioning of these systems: Whis the emergence of the possibilities of the interconnected informatics processing of any processes, it is necessary to approach them both in practical and scientific terms, from unitary positions Therefore, the management system also needs to be interpreted as an inseparable spatial-temporal unit of the material and informational compartments. The general concept of the prospective material (economic) management information system must be based on the automatic integration of all the resources involved in its operation. After the role played in the unitary management process, the informational compartment is divided into two sub-compartments: informative and decisional. The core idea of the new unitary material economic management system resides in the and functionally inter-connected spatial-temporal organization of constituents. From the previously formulated position, it has been established that the present economic information management system is characterized by preserving the more descriptive (reflective) role of situational information; and spatial – temporal approach and realization of information and material processes; direct dependence of the informational potential of the material; increasing the share of external information through the intensification of external relations; the grafual increase of volumes and complicating the composition of situational information. On this basis, it is justified to apply the principle of new problems", which, contain do not deal with informative but alsu decision-making issues.

Only after solving the problem of the automatic obtaining of situational information are created objective conditions of real transition, in mass, at a new, more efficient and qualitative stage of development of the material (economic) management system.

Keywords: analysis, current situation, integrated informatics system, management of human material activities, objectives, issues, constitution

JEL: CF88, D83, G14, L15, O31, O33

Digital versus Conventional Workflows in Prosthodontics and Implant Dentistry

Marius Manole
Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

The integration of digital technologies in prosthodontics and implant dentistry has fundamentally transformed clinical workflows over the past two decades. From intraoral scanning and CAD/CAM fabrication to computer-guided implant surgery and 3D-printed surgical templates, digital tools now compete with — and increasingly complement — long-established conventional techniques. However, the question of when digital workflows offer measurable clinical and economic advantages over conventional ones remains incompletely answered.

Objective: This presentation provides an evidence-based comparative analysis of digital and conventional workflows across the principal stages of prosthodontic and implant treatment, evaluating their performance on two pivotal dimensions: clinical accuracy and treatment time.

Methods: Outcomes evaluated include trueness and precision of digital versus conventional impressions, marginal and internal fit of CAD/CAM versus conventionally fabricated restorations, linear and angular deviation in computer-guided versus freehand implant placement, chair-side and laboratory time, and treatment cost analyses including learning-curve considerations.

Conclusions: Digital and conventional workflows are not mutually exclusive; current evidence supports a stratified, hybrid approach in which clinical indication, case complexity, and operator expertise determine the optimal pathway. The transition from analogue to digital must be guided by outcome-driven evidence rather than technological enthusiasm.

Keywords: Digital workflow; Conventional workflow; CAD/CAM; Computer-guided implant surgery; Intraoral scanning; Prosthodontics; Implant dentistry; Accuracy.

News in Antimicrobial Photodynamic Therapy

Sebastian Pândărelu[1,2], Amelia-Larisa Globașu[1,2], Cojocaru Larisa[*1,2] Cosmin Sinescu[*1,2], Meda Lavinia Negrutiu[1], Emanuela-Lidia Petrescu[1,2]

[1]University of Medicine and Pharmacy"Victor Babeș" Timișoara, Eftimie Murgu Square 2, Timișoara 300041, România

[2]Dental Research Center Using Conventional And Alternative Technologie, Prostheses technology and dental materials Department, Facultaty of Dental Medicine, niversity of Medicine and Pharmacy"Victor Babeș" Timișoara, Revolution 1989 Bd. 9, 300070 Timișoara, România

Antimicrobial resistance (AMR) has emerged as one of the most significant global public health challenges, driving the search for alternative antimicrobial strategies other than conventional antibiotic therapy. Antimicrobial photodynamic therapy (aPDT) has gained increasing attention as a promising non-antibiotic approach due to its ability to inactivate a broad spectrum of microorganisms, including multidrug-resistant bacteria, fungi, and biofilm-associated pathogens. The therapeutic mechanism of aPDT involves the activation of a photosensitizer by light of a specific wavelength in the presence of molecular oxygen, resulting in the generation of reactive oxygen species (ROS) that induce oxidative damage to microbial cellular structures and ultimately lead to cell death (1). Recent advances have significantly expanded the clinical and technological potential of aPDT. Nanotechnology-based delivery systems have improved photosensitizer stability, solubility, targeting capacity, and penetration into microbial biofilms, thereby enhancing antimicrobial efficacy. In parallel, the development of novel photosensitizers and near-infrared (NIR)-activated platforms has enabled deeper tissue penetration and improved treatment outcomes in challenging infections (2).

Clinical evidence has demonstrated beneficial applications of aPDT in dentistry, particularly in endodontics and periodontal therapy, while growing research supports its use in dermatological, antifungal, and wound-care settings. Furthermore, emerging combination strategies integrating aPDT with bacteriophage therapy and other antimicrobial approaches have shown synergistic effects against resistant pathogens. Despite these advances, challenges remain regarding treatment standardization, optimization of light delivery parameters, long-term safety, and large-scale clinical validation. Nevertheless, the multitarget mechanism of aPDT and its low propensity for inducing microbial resistance position this technology as a promising adjunctive or alternative therapeutic modality in the era of increasing antimicrobial resistance.

This review summarizes the most important developments reported during 2025–2026 and discusses future perspectives for the clinical translation and broader implementation of antimicrobial photodynamic therapy.

Keywords: antimicrobial photodynamic therapy; aPDT; antimicrobial resistance; reactive oxygen species; nanotechnology; biofilms; photosensitizers.

References

Shedding light on direct and indirect effects of antimicrobial photodynamic therapy: A review update. Biomed Pharmacother. 2026;200:119396. doi:10.1016/j.biopha.2026.119396

Recent Advances in Nanoparticle-Mediated Antibacterial Photodynamic Therapy. Int J Mol Sci. 2025;26(22):10949. doi:10.3390/ijms262210949

Nexus TMJ: Innovative RAG Based Chatbot Designed for Dentistry Student Centered Learning Approach

Deyan-George Iovanovici[1], Vlad-Gabriel Moacă[2], Dragoș Tudor Lascu[1], Eduard Gîdea Paraschivescu[3], Meda-Lavinia Negruțiu[4,5], Daniela Maria Pop[4,5]

[1.] Faculty of Dental Medicine, "Victor Babeș" University of Medicine and Pharmacy Timișoara, *deyan.iovanovici@student.umft.ro*

[2.] Computer Science (in English), Faculty of Informatics, West University of Timisoara,

[3.]Maxillofacial Surgery Clinic, The Municipal Emergency Clinical Hospital of Timișoara

[4]Department of Prostheses Technology and Dental Materials, Faculty of Dental Medicine, Victor Babeș University of Medicine and Pharmacy of Timișoara

[5]Research Center in Dental Medicine Using Conventional and Alternative Technologies, "Victor Babes" University of Medicine and Pharmacy Timisoara

Introduction: The use of generative AI chatbots as study aids in dental education has seen a steep increase in recent years, however, their reliance on unfiltered internet sources produces factual errors and hallucinations that render them unreliable for clinical education. The study of the temporomandibular joint (TMJ) and the stomatognathic system remains a challenge in the dental curriculum, for which no validated AI-assisted learning tool currently exists. We developed Nexus: Temporomandibularis, a Retrieval-Augmented Generation (RAG)-based chatbot designed for Romanian dental students, trained on a validated dataset based on the dental curriculum bibliography.

Methods: Nexus: Temporomandibularis comprises a web-based interface and a Python back-end RAG architecture, indexing 11 textbooks selected from the bibliography of all Romania's dental schools. Nexus was benchmarked against ChatGPT-4 on 100 domain-specific questions. Accuracy and response latency were measured and compared using a 2-Proportion Z-test. An user-experience survey was subsequently administered to 50 undergraduate dental students and faculty members at a Romanian dental school, who were asked to interact with either Nexus or ChatGPT-4 using identical prompts and rate their satisfaction with the answers.

Results: On internal benchmarking on Timișoara's dental school study curriculum, Nexus achieved a domain-specific response accuracy of 92% compared to 70% for ChatGPT-4 on a 100 domain-specific questions. The evaluation involved delivering identical prompts to Nexus TMJ and ChatGPT-4 and assessing performance by quantifying correct, relevant phrases and the frequency of errors for each output, using the official bibliography of Romanian dental schools as the reference standard. The 50 participants were divided in 2 groups, 25 participants each. Group A was using ChatGPT-4 and got 72 out of 100 domain-specific questions correct. Group B got 92 out of 100 on the same set of questions, resulting in a $p<0.001$. These findings indicate that the specialized Nexus TMJ platform outperformed the generalized large language model in accurately answering the selected medical questions. Response latency was higher for Nexus, operating in two modes, quick thinking (10 seconds) and complex reasoning (50 seconds), compared to 5 seconds for ChatGPT-4. In the satisfaction survey, respondents in the Nexus group reported 20% higher satisfaction scores than the ChatGPT-4 group.Nexus TMJ yielded a significantly higher mean user satisfaction score than ChatGPT-4 (88.5 ± 5.2 vs. 73.2 ± 6.8 out of 100; $p < 0.001$, independent t-test), representing an approximate 20% relative advantage.

Discussions and conclusion: These results suggest that restricting AI retrieval to validated curricular sources improves both response accuracy and user satisfaction in domain-specific dental education. Current limitations include response latency in complex reasoning mode, a small sample size, and the absence of objective learning outcome measures. Future work should focus on expanding the bibliographic database, improving processing speed, and evaluating long-term impact on academic performance through controlled studies across multiple institutions.

Keywords: AI learning, Dentistry Chat-Bot, Retrieval-Augmented Generation, Temporomandibular Joint.

Dynamic OCT Monitoring of Bioceramic Endodontic Sealers Under Acidic Challenge: A Pilot Investigation

Ana-Maria Drai[1,2], Robert Amurăriței[1], Adrian George Marinescu[*1], Meda-Lavinia Negruțiu[1,2], Larisa Cojocaru[1,2], Ioan-Iustin Rîpaș[3], Cosmin Sinescu[1,2]

[1]Victor Babeș University of Medicine and Pharmacy, Faculty of Dentistry, 2 Eftimie Murgu Sq, Timișoara, România

[2]Research Center in Dental Medicine Using Conventional and Alternative Technologies, Faculty of Dental Medicine, "Victor Babeș" University of Medicine and Pharmacy of Timișoara,

[3]Polytechnic University of Timişoara, Vasile Parvan Ave., No. 2, Timisoara, Romania

Introduction Calcium silicate–based sealers are widely used in contemporary endodontics due to their bioactivity and favorable sealing properties. Nevertheless, exposure to the acidic microenvironment associated with periapical inflammation may compromise their physicochemical stability and sealing performance. While previous studies have investigated the influence of acidic pH on setting time, microhardness, solubility, and antimicrobial activity, limited information is available regarding the dynamic behavior of different generations of bioceramic sealers under acidic challenge. Aim To evaluate the stability and sealing behavior of three generations of calcium silicate–based endodontic sealers exposed to an acidic environment using optical coherence tomography (OCT) and microscopic analysis.

Materials and Methods Six extracted multirooted teeth were included in this ongoing pilot investigation. Following standardized chemomechanical preparation, each root canal was obturated using a different calcium silicate–based sealer representing three generations of bioceramic materials: an MTA-based sealer (Generation I), a powder–liquid calcium silicate sealer (Generation II), and a premixed calcium silicate sealer (Generation III). Specimens were immersed in either an acidic medium (pH 5) or phosphate-buffered saline (PBS) for 5, 10, and 15 days prior to evaluation. OCT imaging was performed to assess filling integrity, structural discontinuities, and material stability over time. Subsequent DOM evaluation was performed to correlate OCT findings with direct microscopic observations.

Preliminary Results Data acquisition and image analysis are currently ongoing. Preliminary OCT observations suggest that this methodology enables repeated assessment of filling integrity and material-related changes under acidic challenge. The complete dataset is expected to provide comparative information regarding the stability and sealing performance of different generations of calcium silicate–based sealers exposed to acidic environments.

Conclusions This investigation introduces a multimodal evaluation strategy combining OCT and direct optical microscopy for monitoring the behavior of bioceramic sealers under acidic challenge. The proposed approach may contribute to a better understanding of material behavior in clinically relevant environmental conditions.

The Influence of Botulinum Toxin in Reducing Bruxism

Cojocaru Larisa[1,2], Ioan-Iustin Rîpaș[2,3], Iancu Veronica[2,3] Novac Andreea Codruța[1,2], Baderca (Stoian) Alexandra Denisa[1,2], Drai Ana-Maria[1,2], Popovici Alexandra-Elena[1,2], Negruțiu Meda Lavinia[1,2], Mostovei Andrei[4] Amăricăi Elena Constanța[1,2], Sinescu Cosmin[1,2]

[1]University of Medicine and Pharmacy"Victor Babeș" Timișoara, Eftimie Murgu Square 2, Timișoara 300041, România

[2]Dental Research Center Using Conventional and Alternative Technologie, Prostheses technology and dental materials Department, Facultaty of Dental Medicine, University of Medicine and Pharmacy"Victor Babeș" Timișoara, Revolution 1989 Bd. 9, 300070 Timișoara,

[3]The Polytechnic University of Timișoara, Victory Square 2, Timișoara 300006, România.

[4]Nicolae Testemițanu State University of Medicine and Pharmacy, Stefan cel Mare si Sfant Boulevard 165, MD-2004, Chișinău, Moldova

Bruxism is a masticatory muscle disorder associated with temporomandibular dysfunction, myofascial pain, and dental wear. Botulinum toxin type A (BoNT-A) has gained increasing attention as a therapeutic option due to its ability to inhibit acetylcholine release and reduce masticatory muscle hyperactivity (1). In addition, Nd:YAG photobiomodulation (PBM) has emerged as a non-invasive treatment for temporomandibular disorders (2).

A narrative review of clinical trials, systematic reviews, and meta-analyses was conducted to evaluate the effectiveness of BoNT-A in bruxism and Nd:YAG PBM in temporomandibular disorder management. The analyzed studies demonstrated that BoNT-A significantly reduces pain, occlusal force, and masticatory muscle activity, with therapeutic effects lasting approximately 3–6 months (1). Electromyographic evaluations confirmed decreased muscle hyperactivity and improved patient-reported outcomes. Nd:YAG photobiomodulation exhibited significant analgesic and anti-inflammatory effects, improving mandibular function, quality of life, and accelerating functional recovery in temporomandibular joint disorders (2).

BoNT-A acts through neuromuscular blockade, reducing muscle contraction intensity and associated symptoms, whereas PBM promotes tissue regeneration, modulates inflammation, and improves microcirculation.

Both therapies demonstrated favorable safety profiles and clinical effectiveness. Their integration into a multidisciplinary treatment approach may improve clinical outcomes and patients' quality of life. Further studies are required to establish standardized protocols and assess long-term efficacy.

Keywords: botulinum toxin type A, bruxism, photobiomodulation, Nd:YAG laser, temporomandibular disorders, masticatory muscles.

References

1. Coelho MS, Oliveira JMD, Polmann H, Pauletto P, Stefani CM, Maciel LCDL, et al. Botulinum toxin for bruxism: An overview. Toxins. 2025;17(5):249.

2. Qataya PO, Zaki AM, Amin F, Swedan A, Elkafrawy H. Piano level laser therapy versus epidermal growth factor injection for painful myogenic temporomandibular disorder: A randomized clinical trial. Clin Oral Investig. 2025;29:118.

Silent Infection, Aggressive Disease: HPV and Oral Cancer

Vlad Dragomir , Andrei Ivașcu, Larisa Cojocaru, George Andrei Draghici, Meda-Lavinia Negruțiu, Cosmin Sinescu, Emanuela-Lidia Petrescu

[1]Victor Babeș University of Medicine and Pharmacy, Faculty of Dentistry, 2 Eftimie Murgu Sq, Timișoara, România

[2]Research Center in Dental Medicine Using Conventional and Alternative Technologies, Faculty of Dental Medicine, "Victor Babeș" University of Medicine and Pharmacy of Timișoara,

Introduction: Human papillomavirus (HPV) is one of the most prevalent viral infections worldwide and is increasingly recognized as a major etiological factor in oral and oropharyngeal carcinogenesis. While most HPV infections are transient and asymptomatic, persistent infection with high-risk genotypes, particularly HPV-16, can induce malignant transformation through the action of viral oncoproteins that disrupt key cellular regulatory pathways.

Aim: This presentation aims to highlight the role of HPV in oral carcinogenesis and to review contemporary and emerging strategies for the early detection of HPV-associated oral cancer.

Methods: A narrative review of current evidence was performed, focusing on the molecular mechanisms of HPV-induced carcinogenesis and innovative diagnostic approaches, including salivary biomarkers, circulating tumor HPV DNA (ctHPV-DNA), Optical Coherence Tomography (OCT), and micro-computed tomography (micro-CT). These technologies were evaluated regarding their potential clinical applications in screening, diagnosis, monitoring, and personalized patient management.

Results: High-risk HPV genotypes promote carcinogenesis primarily through the viral oncoproteins E6 and E7, which inactivate the tumor suppressors p53 and pRb, leading to genomic instability and uncontrolled cellular proliferation. Emerging diagnostic technologies offer significant advantages over conventional approaches. Salivary diagnostics and liquid biopsy provide minimally invasive methods for molecular detection and disease surveillance, while OCT and micro-CT enable high-resolution visualization of early structural alterations within oral tissues. The integration of molecular and imaging biomarkers has the potential to improve diagnostic accuracy and facilitate earlier intervention.

Conclusions: HPV-associated oral cancer frequently develops silently before clinical manifestations become evident. Advances in molecular diagnostics and optical imaging are transforming the landscape of oral oncology by enabling earlier detection, more precise monitoring, and personalized treatment strategies. Dentists play a crucial role in prevention, early recognition, and timely referral of patients at risk.

Keywords: HPV, oral cancer, oral oncology, HPV-16, liquid biopsy, salivary biomarkers, optical coherence tomography, micro-CT, early diagnosis, precision dentistry.

Beyond Smoke: The Oral Consequences of Tobacco and Vaping

Andrei Ivașcu, Vlad Dragomir, George Andrei Draghici, Cosmin Sinescu,
Victor Babeş University of Medicine and Pharmacy, Faculty of Dentistry, 2 Eftimie Murgu Sq, Timişoara, România
Research Center in Dental Medicine Using Conventional and Alternative Technologies, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy of Timişoara,

Introduction: The increasing popularity of electronic cigarettes has generated significant debate regarding their safety compared to conventional tobacco products. While both smoking and vaping expose the oral cavity to potentially harmful substances, their biological effects on the oral ecosystem remain an area of active investigation. The oral microbiome, a complex microbial community essential for maintaining oral health, may serve as a key mediator linking tobacco-related exposures to oral disease.

Objective: To evaluate and compare the effects of conventional cigarette smoking and electronic cigarette use on the oral microbiome and to explore their potential implications for oral health and disease.

Materials and Methods: Unstimulated saliva samples were collected from 100 participants, divided equally between conventional cigarette smokers and electronic cigarette users. Microbial DNA was extracted using standardized protocols and analyzed through real-time quantitative polymerase chain reaction (RT-qPCR) and 16S rRNA next-generation sequencing (NGS) using the Illumina iSeq 100 platform. Taxonomic profiles and microbial abundance patterns were compared between the two groups.

Results: Both smoking modalities were associated with significant alterations of the oral microbiome. Conventional smokers demonstrated an increased abundance of anaerobic periodontal pathogens, particularly Porphyromonas and Fusobacterium, organisms strongly associated with periodontal tissue destruction. In contrast, electronic cigarette users exhibited higher relative levels of Streptococcus and Veillonella, suggesting a distinct microbial adaptation to aerosol exposure. Although the microbial signatures differed, both groups displayed evidence of oral dysbiosis and inflammatory imbalance.

Conclusions: The findings indicate that tobacco smoke and electronic cigarette aerosols exert different selective pressures on the oral microbiome, leading to distinct but potentially harmful microbial profiles. Conventional smoking appears to promote a more aggressive periodontal environment, whereas vaping induces alternative ecological shifts whose long-term clinical consequences remain uncertain. Advanced molecular profiling techniques such as RT-qPCR and NGS provide valuable insights into these changes and may support the development of personalized preventive and therapeutic approaches in modern dentistry.

Keywords: tobacco smoking, vaping, oral microbiome, oral dysbiosis, periodontal disease, electronic cigarettes, next-generation sequencing, oral health.

Next-Gen Scaffolds: Additive Biomanufacturing of Tissues

Diana Bianca Patrulescu[1,2], Armin Yahyazadeh[1,2], Larisa Cojocaru[1,2], Ioan Iustin Rîpaș[2,3], Ana-Maria Drai[1,2], Daniela Maria Pop[1,2], Emanuela Lidia Crăciunescu[1,2], Andreea Codruța Novac[1,2], Meda Lavinia Negruțiu[1,2], Cosmin Sinescu[1,2]

[1]University of Medicine and Pharmacy ”Victor Babeș” Timișoara, Eftimie Murgu Square 2, Timișoara 300041, România

[2]Dental Research Center Using Conventional And Alternative Technologie, Prostheses Technology and Dental Materials Department, Faculty of Dental Medicine, University of Medicine and Pharmacy”Victor Babeș” Timișoara, Revolution 1989 Bd. 9, 300070 Timișoara, România

[3]The Polytechnic University of Timișoara, Victory Square 2, Timișoara 300006, România.

Introduction: Bone tissue engineering is advancing rapidly through 3D bioprinting which allows the fabrication of customized scaffolds using biocompatible materials that support bone regeneration and mimic natural tissue structure.

Aim of Study: This study aims to highlight the potential of 3D bioprinting in dental medicine and its applications in bone tissue regeneration.

Materials and Methods: A review of recent scientific literature on 3D bioprinting in dentistry was conducted using databases such as PubMed, Web of Science, and ScienceDirect. Preliminary experimental work was also performed using the BIO X (Cellink) bioprinter with polycaprolactone (PCL) and Cellink Alginate to evaluate printability and scaffold stability.

Results and Discussions: Current research confirms the growing role of 3D bioprinting in regenerative dentistry, especially for bone reconstruction. In our experiments the PCL scaffold showed good structural stability while the alginate scaffold demonstrated lower mechanical resistance and slight deformation. Printing 1 × 1 × 1 cm scaffolds required repeated parameter adjustments making the process technically challenging.

Conclusions: 3D bioprinting has strong potential in regenerative dentistry due to its ability to create precise and customizable scaffolds. However technical limitations and material related challenges still require further optimization and research.

Keywords: 3D bioprinting, tissue engineering, bone scaffold, additive manufacturing, biomanufacturing, biomaterials, bioinks, mechanical strength.

References

Chimene D, Miller L, Cross LM, Jaiswal MK, Singh I, Gaharwar AK. Nanoengineered osteoinductive bioink for 3D bioprinting bone tissue. Biomaterials. 2018;164:164 178.

Mandrycky C, Wang Z, Kim K, Kim D H. 3D bioprinting for engineering complex tissues. Biotechnol Adv. 2016;34(4):422 434.

Redefining Dental Diagnostics: AI, Fluorescence Imaging and Early Lesion Detection

Armin Yahyazadeh[1,2], Diana Bianca Patrulescu[1,2], Larisa Cojocaru[1,2], Ioan Iustin Rîpaș[2,3], Ana-Maria Drai[1,2], Daniela Maria Pop[1,2], Emanuela Lidia Crăciunescu[1,2], Andreea Codruța Novac[1,2], Meda Lavinia Negruțiu[1,2], Cosmin Sinescu[1,2]

[1]University of Medicine and Pharmacy"Victor Babeș" Timișoara, Eftimie Murgu Square 2, Timișoara 300041, România

[2]Dental Research Center Using Conventional And Alternative Technologie, Prostheses technology and dental materials Department, Facultaty of Dental Medicine, niversity of Medicine and Pharmacy"Victor Babeș" Timișoara, Revolution 1989 Bd. 9, 300070 Timișoara, România

[3]The Polytechnic University of Timișoara, Victory Square 2, Timișoara 300006, România.

Introduction: Artificial Intelligence is rapidly transforming dentistry by improving diagnostic accuracy and supporting clinicians in the interpretation of radiographic and optical images. Machine learning and deep learning systems can identify pathological patterns and assist in the early detection of oral lesions.

Aim of study: This paper aims to present the current applications of AI in dentistry and its contribution to diagnostic improvement, with emphasis on radiographic analysis and fluorescence imaging for detecting oral abnormalities and potentially malignant lesions.

Materials and Methods: A narrative review of recent scientific literature was conducted, focusing on AI-assisted radiographic interpretation, fluorescence imaging systems and neural network algorithms used in the detection and classification of oral mucosal lesions.

Results and Discussion: Studies show that AI systems are effective in detecting oral pathological changes and improving lesion visualization through fluorescence analysis and image segmentation. These technologies may reduce diagnostic subjectivity and enhance early detection compared to conventional examination methods.

Conclusions: Artificial Intelligence shows strong potential for integration into future dental practice particularly in diagnostic procedures and image interpretation. However further clinical validation and standardized methodologies are still required for widespread implementation.

Keywords: artificial intelligence, oral id, cancer, hpv, dental diagnostics, radiographic interpretation, oral lesion detection, deep learning, digital imaging.

References

Sahoo RR, Sahoo KC, Dash GC, Kumar G, Baliarsingh SS, Panda B, et al. Diagnostic performance of artificial intelligence in detecting oral potentially malignant disorders and oral cancer using medical diagnostic imaging: a systematic review and meta-analysis. Front Oral Health. 2024;5:1494867.

Vinay V, Jodalli P, Chavan MS, Buddhikot CS, Luke AM, Ingafou MSH, et al. Artificial Intelligence in Oral Cancer: A Comprehensive Scoping Review of Diagnostic and Prognostic Applications. Diagnostics. 2025;15(3):280.

The AI-Empowered Patient: A View for Citizens and Clinicians.

Gheorghe Ioan Mihalaș*, Minodora Andor
Victor Babeș University of Medicine and Pharmacy, TimisoaraEftimie Murgu Sq no.2, 300041, Romania,

Introduction. Generative AI chatbots (ChatGPT, Gemini, Claude) have fundamentally changed how citizens seek health information. Unlike the era of "Dr. Google", which returned fragmented links, today's AI provides coherent, persuasive narratives. Patients and healthy individuals now consult AI for symptom interpretation, medication advice, lifestyle management, and second opinions. This raises critical questions about accuracy, trust, and the medical community's response.

Objective and Methods: This paper provides an evidence-based overview of the AI-empowered patient/citizen for a heterogeneous audience (clinicians, policymakers, developers, and the public). We synthesize recent data on usage patterns, diagnostic accuracy, hallucinations, user trust, and future projections. We reviewed surveys and studies published between 2025–2026 from Pew Research Center, West Health-Gallup, Yale School of Medicine, Mass General Brigham and JAMA Internal Medicine.

Key findings: Approximately 32–36% of US adults have used AI for health information. Users fall into three behavioral types (anxious verifier, collaborator, self-diagnose) and four technological levels (general chatbot to autonomous agents). While AI achieves 85–92% diagnostic accuracy in controlled settings, it recommends unnecessary investigations in >90% of cases and potentially harmful treatments in 60–67%. Hallucinations occur in 53–83% of responses. Trust often exceeds accuracy: 45% of adults trust AI for health information; 25% have followed AI advice without seeing a clinician—of whom 23% reported harm. Predictions: By 2030, the global AI health market will grow to $1.6 trillion. Patients will become active health managers; clinicians will shift to strategic guides. AI will predict risks for >1,000 diseases.

Recommendations: Medical schools must integrate AI literacy into core curricula. Health authorities should enforce the EU AI Act, mandate transparent labelling, and launch digital health literacy campaigns. Clinicians should adopt a curious, non-defensive attitude ("What did the AI tell you?") and use shared triage to validate correct information while adding what AI cannot know (physical exam, context). Media should partner with experts to counter misinformation. Developers must implement safety warnings and submit to independent audits.

Conclusions: The AI-empowered patient is today's reality. AI is a valuable assistant but an unreliable independent diagnostician. Success depends on human adaptation—not technology alone—and on collaboration between citizens, clinicians, and well-designed AI systems.

Keywords: AI-empowered patient, health chatbots, hallucinations, trust in AI, medical education.

References.

Pew Research Center. (2026). Where do Americans get health information, and what do they trust? https://www.pewresearch.org/ (as on April 27, 2026)

Mihalas GI. (2025). Optimizing Patient-AI Dialogue: Integrating Empathic Technology. Stud. Health Technol. Inform. 2025, 328: 111-115, doi:10.3233/SHTI250683

Mihalaș GI. (2025). Inteligența Artificială în Medicină. Ghid de conversație pentru medici, studenți și pacienți. Timișoara: Ed. Victor Babeș, ISBN 978-606-786-473-1.

3D Biomimetic piezoelectric scaffolds-based therapeutic approach for volumetric muscle loss repair

Oana Dobre
Centre for the Cellular Microenvironment, Advanced Research Centre, University of Glasgow, United Kingdom.

Volumetric muscle loss (VML), a debilitating disease that poses a significant challenge to regenerative medicine. Current treatments, often relying on acellular scaffolds, frequently lead to fibrotic tissue formation, limiting functional recovery. We investigate into the exciting potential of bio-piezoelectric scaffolds, a novel class of biomaterials that mimic the natural electrical and mechanical properties of muscle tissue, to revolutionize VML repair. Muscle tissue is not a passive structure but a dynamic environment constantly responding to electrical and mechanical cues. These signals are crucial for regulating muscle growth, repair, and function, are often absent in conventional scaffolds.

Our research focuses on the development of 3D biomimetic piezoelectric scaffolds, employing the biodegradable and biocompatible polymer from the Polyhydroxyalkanoates (PHA) family. Electrospun fibers, incorporated into an extracellular matrix (ECM) hydrogel, provide a robust and biocompatible scaffold that mimics the mechanical properties of muscle tissue. Importantly, PHAs exhibit a piezoelectric effect, generating an electrical charge upon mechanical deformation. This intrinsic property allows the scaffold to respond dynamically to muscle contraction and relaxation, creating a bio-electric environment that closely resembles the native tissue.

In vitro studies using myoblast cells demonstrate enhanced cell adhesion, proliferation, and differentiation within the 3D bio-piezoelectric scaffolds. These cells exhibited increased expression of muscle-specific markers, such as MyoD, indicative of robust muscle regeneration. Preliminary in vivo studies using a mouse model of VML showcase the potential of bio-piezoelectric scaffolds for inducing functional muscle regeneration. The scaffolds promoted the formation of new muscle tissue, improving muscle function and reducing fibrosis. Bio-piezoelectric scaffolds offer a unique opportunity to overcome the limitations of current VML treatments, leading to improved functional recovery and a higher quality of life for patients. This presentation will discuss the ongoing research, including the exploration of bioprinting techniques to develop complex and customizable scaffolds, the investigation of the role of specific biomolecules in regulating muscle regeneration, and the potential application of this technology in treating diverse muscle injuries.

Visible Pain and Invisible Suffering. Smart Pain Care: Artificial Intelligence in Personalized Pain Medicine

Dr. Luminosu Paul-Manuel MD.

PhD S. University of Medicine and Pharmacy "Victor Babes" Timisoara, Department of Anaesthesia and Intensive Care & Interventional Pain Therapy, Nord Hospital, Pipera, Bucharest, Romania,
paul.luminosu@umft.ro

In pain management practice, the major challenge is not always controlling severe pain but rather managing patients in whom the underlying pain mechanism remains incompletely defined and whose response to treatment is difficult to predict. Cases of persistent postoperative pain, Failed Back Surgery Syndrome, Complex Regional Pain Syndrome, Chronic Pelvic Pain, or Fibromyalgia illustrate the complexity of modern pain medicine, where nociceptive, neuropathic, and nociplastic components frequently coexist. In such situations, artificial intelligence (AI) may serve as a complementary clinical tool for reducing diagnostic uncertainty and optimizing therapeutic decision-making. By simultaneously integrating clinical data, functional scores, medical imaging, neurophysiological parameters, autonomic biomarkers, and treatment history, machine learning algorithms can identify patterns that are difficult to recognize through conventional clinical assessment.

This presentation explores the practical applications of AI in pain management, with a focus on five challenging clinical scenarios. The role of AI in differentiating pain mechanisms, predicting pain chronification, selecting patients for interventional procedures such as nerve blocks, radiofrequency ablation, or neuromodulation, and early identification of non-responders will be discussed. Special attention will be given to the potential of AI to support precision medicine through individualized phenotyping and the selection of the most appropriate treatment for each patient.

Although promising, clinical implementation raises important challenges related to data quality, algorithmic bias, and model interpretability. In pain management, where the physician–patient relationship remains fundamental, AI does not replace clinical expertise but rather enhances it. The future belongs to a practice in which advanced technology helps clinicians look beyond expressed pain and gain a deeper understanding of patient suffering.

Interaction of Self-Assembled Amphiphiles with Circulatory System Esterases and Its Relevance to Drug Delivery

Shibbir A Khan[1], Uttam Satyal[1], Tashnuva Rifat[1], Vishnu D. Sharma[1], Marc A. Ilies[1*]

[1]Department of Pharmaceutical Sciences and Moulder Center for Drug Discovery Research, Temple University School of Pharmacy, Philadelphia PA-19140, USA

*e-mail address of corresponding author: mailies@temple.edu

Amphiphilic block copolymers containing hydrophilic polyethylene glycol attached to hydrophobic biodegradable polyester blocks, such as PEG-PLA or PEG-PCL, can act in self-assembled (micellar) form as drug delivery systems (DDSs) for the management of metastatic non-small-cell lung cancer, breast cancer and ovarian cancer with proved clinical efficiency (Genexol-PM approved in Korea and under advanced clinical trials in the U.S.). We engineered a set of PEG-PCL diblock copolymers through insertion of a PBO short block in between the hydrophilic and hydrophobic block and we characterized their self-assemblies in aqueous solutions and the ability of these supramolecular assemblies to load hydrophobic drugs [1-3]. We also developed methodology to test the stability of these assemblies against different esterases present in blood/tissues [4,5] and we evaluated the impact of the tuned interfaces on the micelle stability against these enzymes [2-4, 6]. We will present our newest results towards selective stabilization of the polymeric micelles in circulation/targeted tissues and their impact in drug delivery for the treatment of breast cancer.

Keywords: Medicine, Biochemistry, Breast Cancer, Block copolymers, Self-assembling, Drug encapsulation, Drug delivery, Esterases, Lipases, Kinetic parameters, Cellular and animal models

References

[1] Zhu, X.; Fryd, M, Tran, B. D., Ilies, M. A.; et al., Modifying the Hydrophilic-Hydrophobic Interface of PEG-b-PCL to Increase Micelle Stability: Preparation of PEG-b-PBO-b-PCL Triblock Copolymers, Micelle Formation and Hydrolysis Kinetics. Macromolecules 2012, 45, 660-665.

[2] Zhu, X.; Sharma, V. D.; Fryd, M.; Ilies, M. A.; et al., Lipase Catalyzed Degradation of Amphiphilic Block Copolymer Micelles: Interfacial Activation Model. Polymer 2013, 54 (12), 2879-2886.

[3] Satyal, U.; Sharma, V. D.; Shif, J. A.; Ilies, M. A. Interface-Engineered Amphiphilic Block Copolymers with Tuned Enzymatic Resistance for Controlled Delivery of Chemotherapeutic Drugs. in "Control of Amphiphile Self-Assembling at the Molecular Level: Supra-Molecular Assemblies with Tuned Physicochemical Properties for Delivery Applications, ACS Books 2017, 211-229.

[4] Lam L., Ilies M. A., Evaluation of the Impact of Esterases and Lipases from the Circulatory System against Substrates of Different Lipophilicity, Int. J. Mol. Sci. 2022, 23, 1262.

[5] Khan S. A., Ilies M. A., The Phospholipase A2 Superfamily: Structure, Isozymes, Catalysis, Physiologic and Pathologic Roles. Int. J. Mol. Sci. 2023, 24, 1353.

[6] Khan S. A., Ilies M. A., Development and Optimization of a Bromothymol Blue-Based PLA2 Assay Involving POPC-Based Self-Assemblies. *Int. J. Mol. Sci.,* 2024, 25 (17), 9517.

Long-Term Circulatory Assistance with the HeartMate 3 Centrifugal Pump

Horatiu Moldovan
Professor of Cardiovascular Surgery - Carol Davila University of Medicine and Pharmacy
Head, Department of Cardiovascular Surgery and Heart Transplantation, Clinical Emergency Hospital Bucharest
Full member, Romanian Academy of Medical Sciences (ASM)
Full member, Academy of Romanian Scientists (AOSR)
President of the Romanian Society of Cardiovascular Surgery (SRCCV)
President of ROMTRANSPLANT Association

Advanced heart failure remains associated with high morbidity and mortality despite significant advances in medical therapy. Estimated survival for the patients is less than 5% at 5 years. Durable left ventricular assist devices (LVADs) have emerged as an established therapeutic option for patients with end-stage heart failure, ether as a bridge to transplantation or as destination therapy.

The HeartMate 3, a fulley magnetically levitated centrifugal-flow pump, has demonstrated favorable outcomes regarding survival, hemocompatibility and device durability.

Actual devices have a reduced risk of infection, bleeding, thrombosis, or stroke.

Survival at 5 years with LVAD devices is nearly 60%, comparable to the poor referral rate of patients into our medical centers and even due to limited knowledge of LVADs outcomes or quality of life.

We present our experience with the HeartMate 3 LVAD implantations, one of them in a BIVAD configuration.