

**PIEZ**   
**4SPINE**  
NEWSLETTER

**Nº1**

OUR RADICAL VISION  
PIEZO4SPINE AND STAKEHOLDERS  
PIEZO4SPINE GOES PUBLIC  
SCIENTIFIC ACHIEVEMENTS  
PIEZO4SPINE IN THE MEDIA  
NEWS & ANNOUNCEMENTS

# FIRST

# PIEZO4SPINE NEWSLETTER

Welcome to the first issue of our Piezo4Spine newsletter, marking a significant milestone in the journey of this **HORIZON EUROPE EIC Pathfinder Project**. We were launching this ground-breaking project in January this year and are happy to collectively present you the first highlights of this exciting project period.

Our journey began with a kick-off meeting in Madrid, hosted by our coordinating partner CSIC, setting the stage for collaboration and forward-thinking.

This first year has been marked by notable scientific achievements, including the publication of two research papers that highlight our project's progress. Our regular online meetings have been a hub of vibrant discussions and idea-sharing, contributing significantly to the project's momentum.

The second project meeting took place in November, in Ferrara, Italy, hosted by our partner, the IIT. This meeting was an encouraging event, wrapping up our first scientific achievements and setting the course for future endeavors.

As you explore this newsletter, you will get an insight into the key highlights and accomplishments of the inaugural year of Piezo4Spine. We wish you a pleasant reading!

YOURS SINCERELY,  
THE PIEZO4SPINE TEAM





# OUR RADICAL VISION

## THE GLOBAL CHALLENGE OF SPINAL CORD INJURIES

Annually, between 250,000 and 500,000 people worldwide suffer from spinal cord injuries (SCIs), predominantly due to preventable causes like road accidents, falls, and violence. These injuries severely disrupt neural circuits, impairing connectivity between the brain and the rest of the body. The complex nature of these injuries, influenced by factors such as injury severity and location, has so far limited treatment options to merely symptomatic relief <sup>1</sup>.

## OUR AIM: REVOLUTIONIZING SCI RESEARCH

Piezo4Spine is dedicated to developing a novel multifactorial therapy for SCI, focusing on two pivotal aspects of neural repair: mechanotransduction and inhibitory scarring. Our approach is designed to more effectively tackle the complexities of SCIs, offering new possibilities for therapies and functional recovery.

## OUR CUTTING-EDGE-TECHNOLOGY

Leveraging advancements in Nanotechnology, Molecular Biology, Tissue Engineering and Neuroelectronics, Piezo4Spine is developing a bioprinted 3D mesh, the '3D-theramesh', infused with nanocarriers. These carriers are engineered to deliver gene therapeutic agents to injury sites via wireless powering.

## OUR IMPACT

Our interdisciplinary consortium aims to transcend the limitations of current technologies by addressing multiple cellular targets involved in neural regeneration. This includes a balanced combination of therapeutic interventions focusing on mechanotransduction and inhibitory scarring, which has the potential to significantly enhance functional recovery after SCI and pave the way for novel treatments in various other neural and non-neural pathologies.

Discover more about our project's aims and groundbreaking approach by watching our informative video on [YouTube](#) and on [www.piezo4spine.eu](http://www.piezo4spine.eu).



<sup>1</sup> <https://www.who.int/news-room/fact-sheets/detail/spinal-cord-injury>

# PIEZO4SPINE AND STAKEHOLDERS

## CREATE SEMINAR

AT PENNSYLVANIA STATE UNIVERSITY,  
USA (APRIL 2023)

María Concepción Serrano, as the coordinator of the Piezo4Spine project and member of the MaMBIO Group at ICMM-CSIC, was honored to present at the esteemed CREATE Seminar Series hosted by the Huck Institutes of Life Sciences at Penn State University. Her talk, "Nanomaterials for the design of novel therapeutics in neural repair," highlighted the Piezo4Spine project's innovative approach for neural repair.

The MaMBIO Group deeply appreciated this opportunity provided by Prof. Jian Yang and the Huck Institutes of Life Sciences to engage with the academic community in the U.S.A. and found the visit to be a valuable and enriching experience.

The Huck Institutes of Life Sciences is renowned for fostering interdisciplinary research and education in life sciences within the state-of-the-art Millennium Science Complex at Penn State. It comprises multiple centers and institutes that contribute to various fields, including biology, medicine, and genetics, aiming to propel excellence in these domains.



## NEUROSTIMSPINAL WORKSHOP

On September 29, 2023, María C. Serrano shared her expertise during a talk at the final NeuroStimSpinal workshop. She covered the promising research progress of the MaMBIO group, encapsulating the innovations of the Piezo4Spine project. This event was a collaborative effort with the consortium of the H2020 FET-OPEN project [NeuroStimSpinal](#).

NeuroStimSpinal is a pioneering project focusing on developing an engineered neural tissue scaffold. This scaffold is aimed to mimic the spinal cord's morphology,

combining fibrous and porous structures with the potent properties of graphene-related materials in a protein-rich decellularized matrix. The scaffold is designed to preserve neural cell survival and enhance the differentiation of neural progenitor cells, which is crucial for neural regeneration.

This collaboration is a strategic fusion of two pioneering approaches: Piezo4Spine focuses on delivering bioactive gene therapeutics via a sophisticated theramesh loaded with nanoparticles, while NeuroStimSpinal designs a graphene-based scaffold that facilitates neural growth and connectivity by electrical stimulation. By synergizing the strengths of both of these innovative projects, we aim to push the boundaries of what is possible in SCI therapy and beyond.

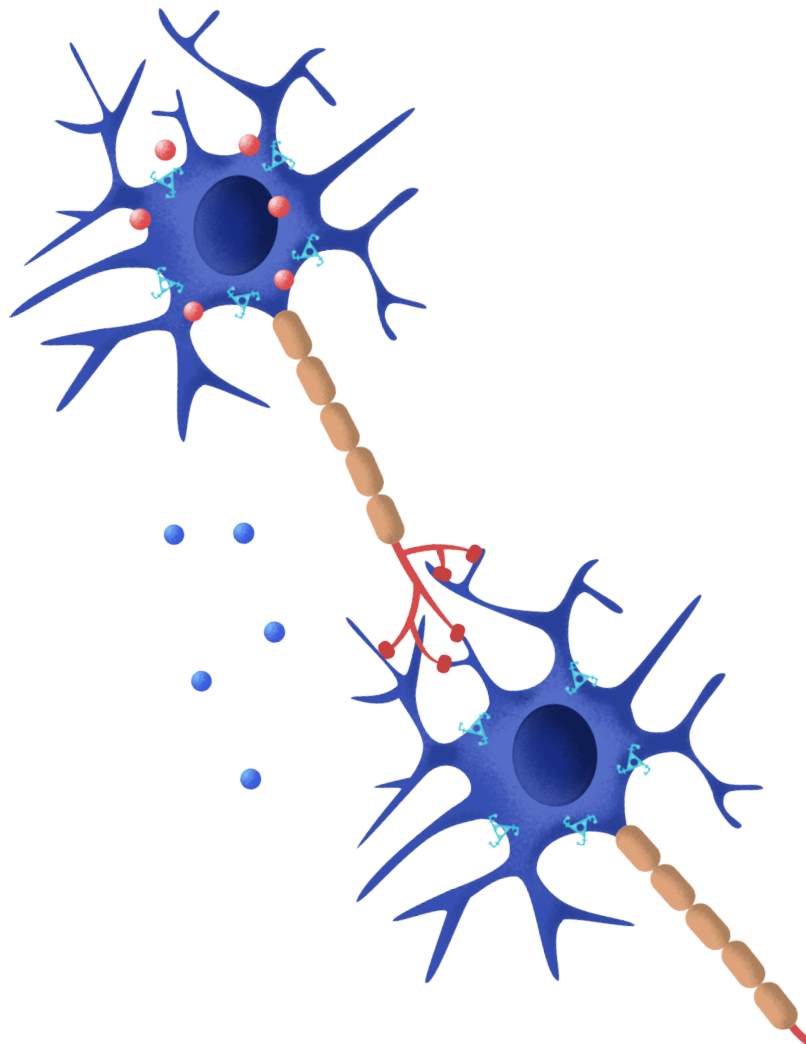


# PIEZO4SPINE GOES *PUBLIC*

In this section, we want to showcase our dedication to engaging with the broader community and fostering interest in our pioneering work, especially among young audiences including children, adolescents, and undergraduate/graduate students. Throughout this year, Piezo4Spine researchers have been part of numerous public events, contributing to raising awareness about the exciting field of spinal cord research.

Among these activities were lab-tours at the Institute of Materials Science of Madrid (ICMM-CSIC) during the Semana de la Ciencia y Tecnología, hosted by the ForceTool and MaMBIO Groups which gave insights in atomic force microscopy and cell culture techniques, respectively, and the Brain Awareness Week in March 2023, organized by our partner SESCOAM.

HERE ARE SOME MORE HIGHLIGHTS



GENDER PERSPECTIVES

## PIEZO4SPINE'S INCLUSIVE OUTREACH

As the year unfolded, our commitment to gender equity in science was brought to the forefront with the '11F – International Day of Women and Girls in Science'. On February 10<sup>th</sup>, the Piezo4Spine project was showcased to secondary school students, highlighting the significant contributions of female researchers and aiming to ignite a passion for science among the youth.

Then, in the course of the CSIC Ciudad Ciencia project, we extended our focus on gender perspectives in scientific research to the residents of Cuéllar, Segovia, on March 23<sup>rd</sup>. During the 'De la mano de grandes mujeres' ('Hand in Hand with Great Women') session, Piezo4Spine was presented as a beacon of inclusive innovation, reflecting on how diverse viewpoints are not just enriching but are also integral to pioneering advancements in scientific research.



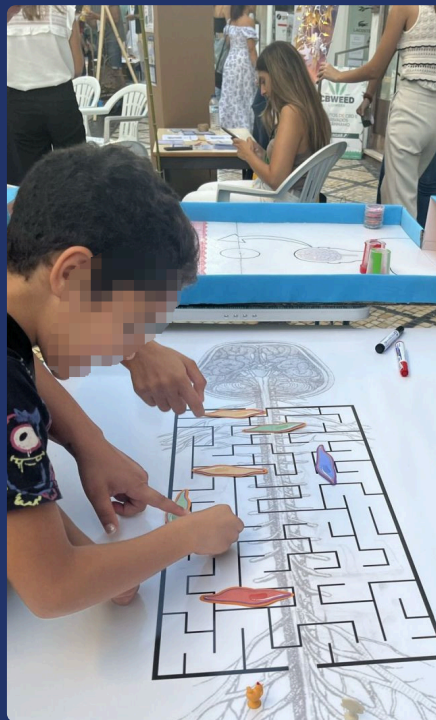
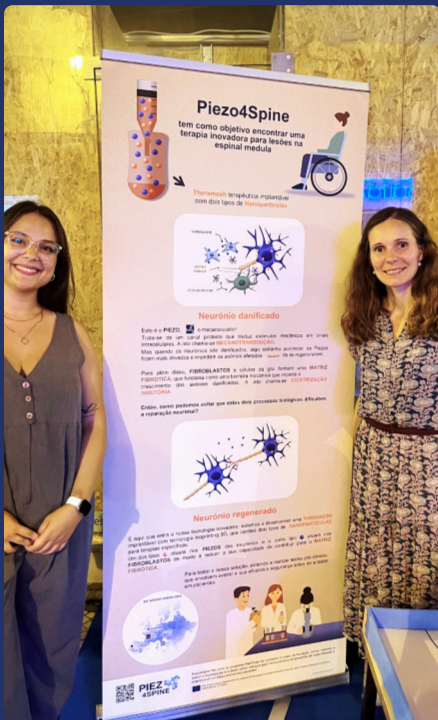
## EUROPE DAY

On May 9<sup>th</sup>, 2023, within the walls of the Eugenio Trias Library in Madrid, the Piezo4Spine project was proudly introduced to an audience of high school students, in an event organized by our coordinating partner CSIC and the UAM to commemorate Europe Day. This date holds special significance as it celebrates the anniversary of the "Schumann Declaration" of 1950, when French Minister Robert Schumann set forth the idea of the European Coal and Steel Community. This visionary concept laid the foundation for what would evolve into the modern European Union, a proof to the power of collaborative effort and unity.

Our project exemplifies this legacy by harnessing multidisciplinary European collaboration to advance spinal cord research. The introduction of our project by Julia Martínèz und María C. Serrano from the MaMBIO Group was a great reminder of how diversity drives innovation.



## EUROPEAN RESEARCHERS' NIGHTS



Our Piezo4Spine researchers from the University of Coimbra (event in Coimbra, Portugal), the CSIC (event in Madrid, Spain), and acib (event in Graz, Austria) had a blast bringing our research to life through some engaging hands-on experiences. There is something magical about seeing the spark of curiosity ignite in the eyes of children and young adults as they dive into the world of science.

22 DE JULHO A 6 DE AGOSTO DE 2023 DIÁRIO JORNAL REPUBLICANO ÓRGÃO REGIONALISTA DAS BERRAS HÁ 43 ANOS A INFORMAR

# Diário de Coimbra

Fundador Adriano Lucas (1883-1950) | Diretor "in memoriam" Adriano Lucas (1925-2011) | Diretor Adriano Calle Lucas

27 JUL. > 06 AGO

## EXPOFACIC ESPERA 400 MIL COM UMA VISITA ESPECIAL

Durante os onze dias do certame são diversos os artistas e espetáculos que vão abrilhantar a festa, mas a grande atração visitou hoje o Diário de Coimbra **Destaque**

**Presidente da Câmara de Cantanhede diz que Expofacic é evento que as pessoas valorizam e é de visita obrigatória**

**31.ª edição do maior evento "a nível regional", e com ambições de "alcançar o patamar nacional".**

**2500 metros quadrados de áreas cobertas é a oferta da EXPOFACIC**

**500 expositores vão mostrar o que de melhor fazem no certame de Cantanhede**

MANUAIS ESCOLARES FNAC  
**ENCOMENDA CONHECIMENTO**

TROCA OS TEUS vouchers  
Manuais Escolares Grátis

25 anos FNAC



## EXPOFACIC FAIR IN CANTANHEDE (PORTUGAL)

Lino Ferreira and his Advanced Therapies Group from the University of Coimbra participated at the renowned EXPOFACIC fair in Cantanhede. Held annually between July and August. EXPOFACIC is a prominent event in Portugal, known for its amalgamation of music,

entertainment, gastronomy, exhibitions, and business opportunities. This year, the event attracted a diverse audience to its expansive venue, offering over 600 exhibitor spaces in a 100,000 m<sup>2</sup> area. Lino and co-workers made a significant contribution to the fair's scientific and technological front by also introducing the Piezo4Spine project and effectively bridging the gap between advanced scientific research and public outreach.



# SCIENTIFIC ACHIEVEMENTS

## NANOPARTICLE INNOVATIONS

PUBLISHED IN  
ACS APPLIED MATERIALS AND INTERFACES

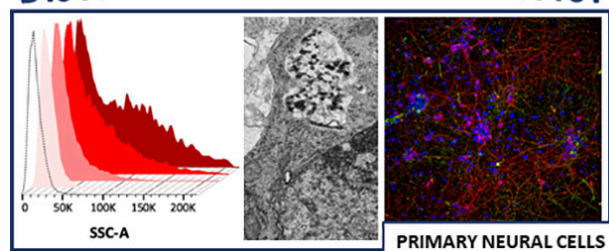
In the April issue of ACS Applied Materials and Interfaces, the MaMBIO Group of CSIC published a study, revealing how small changes in the properties of superparamagnetic iron oxide nanoparticles (SPIONs) can dramatically influence their interaction with primary neural cells. Their research compared two types of SPIONs: NFA, with a denser core and slightly less negative charge, and NFD, with a larger surface area and more negative charge.

Key findings include distinct biological responses based on the type of SPION. NFA SPIONs show higher cell uptake and a more pronounced impact on cell viability, while NFD SPIONs, due to their more negative charge, more significantly alter cellular lipid content and increase membrane fluidity. This study highlights the potential of these nanoparticles in targeting specific cellular processes, offering exciting prospects for their use in nanomedicine, particularly for treatments involving neural cells.

SLIGHT CHANGES IN PHYSICO-CHEMICAL PROPERTIES



DISTINCTIVE BIOLOGICAL IMPACT



FOLLOW THE LINK TO FULL PUBLICATION

<https://doi.org/10.1021/acsami.3c02729>

## NANOMECHANICS OF CELLS

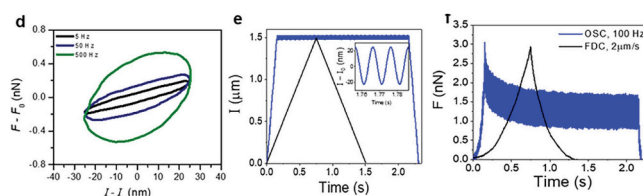
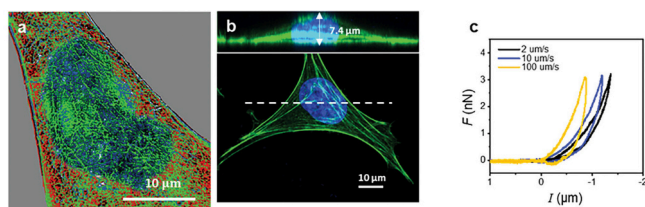
PUBLISHED IN SMALL

The November issue of Small features an insightful study by the Force Tool and MaMBIO Groups (CSIC), titled "Nanorheology and Nanoindentation Revealed a Softening and an Increased Viscous Fluidity of Adherent Mammalian Cells upon Increasing the Frequency." This research uncovers how the mechanical properties of cells, such as HeLa and fibroblasts, change with the frequency of deformation.

Key findings include cells softening and becoming more fluid-like as the frequency or velocity of deformation increases. At lower frequencies or velocities, the cell surface mechanics are dominant, while at higher frequencies or velocities, the cytosol's hydrodynamic drag takes precedence. This study suggests that the mechanical properties of cells can vary significantly with different probing conditions, offering new perspectives on cellular behavior in varying mechanical environments.

FIND THE FULL PUBLICATION HERE

<https://doi.org/10.1002/smll.202304884>





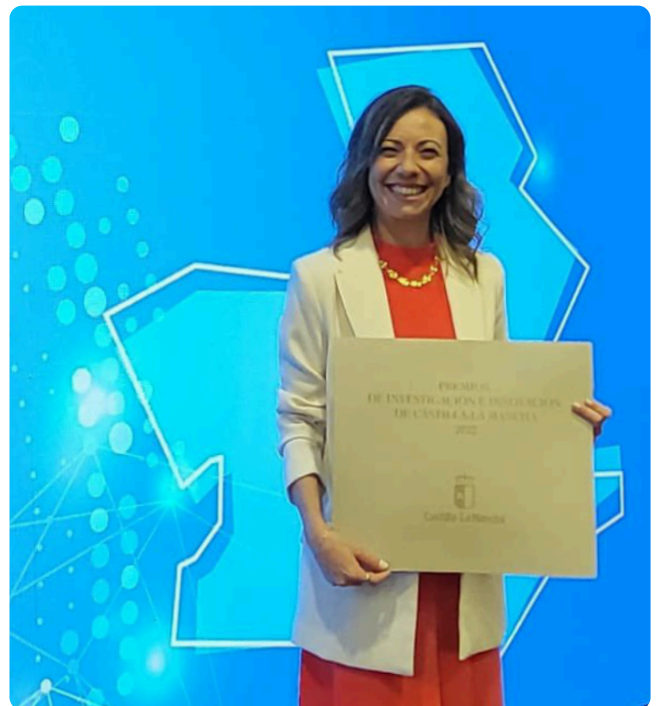
# AWARDS

**We are thrilled to spotlight the scientific achievements of two distinguished Piezo4Spine researchers, whose contributions were recently celebrated with prestigious awards.**

**Dr. Juliana M. Rosa**, a PhD pharmacologist and Group Leader of the Neural Circuits and Behaviour Lab at the National Hospital for Paraplegics (SESCAM), was honored with the Young Research and Innovation Award from Castilla-La Mancha in March. This accolade recognizes her significant contributions in the field of pharmacology, particularly in neurophysiology and neural circuits, highlighting her role as a leading figure in advancing medical research and innovation.

Alongside her, **Prof. Ricardo García** from the Institute of Materials Science of Madrid (ICMM-CSIC) received the esteemed "Premio Miguel Catalán," the highest scientific recognition awarded by the Comunidad de Madrid. García, leader of the ForceTool Group, has been acknowledged for his nearly four decades of dedicated scientific research. His most notable contribution includes the discovery of bimodal technology in force microscopy, a breakthrough that has found applications in both basic science and the industrial world.

These awards not only underscore the individual excellence of Dr. Rosa and Prof. García but also reflect the high caliber of research within the Piezo4Spine project.



**WE HEARTILY CONGRATULATE ON THEIR OUTSTANDING ACHIEVEMENTS!**

# PIEZO4SPINE IN THE MEDIA

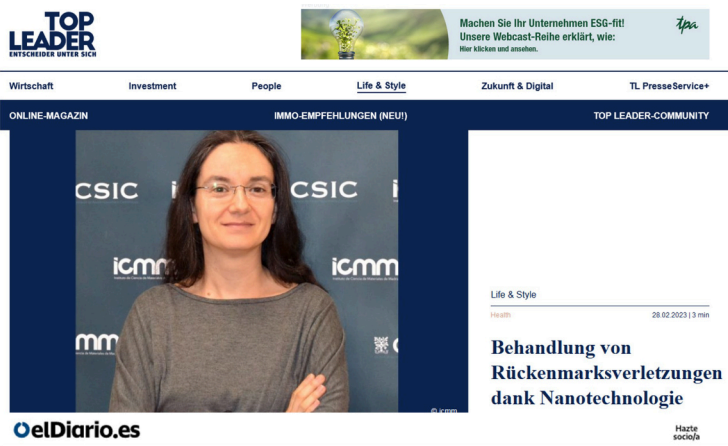
## PRESS ARTICLES

Piezo4Spine has been making significant waves in the media landscape. A series of well-coordinated press releases led to extensive coverage in numerous national media outlets, including notable features in Austria's "Top Leader" and Spain's "Radio Televisión Española".

Our project's coordinator, María C. Serrano, has been particularly active in raising awareness, exemplified by

her detailed **interview in "El País", Spain's leading daily newspaper, on May 4, 2023.** In this interview, titled "This disease can be cured" she eloquently discussed the potential of the Piezo4Spine project. Moreover, María C. Serrano and Juliana M. Rosa were guests on **Radio Nacional de España (RNE)**, bringing the project's objectives to a broader audience. This radio experience really captured María and Juliana, who got fascinated by the professionalism of Manuel Seara in his radio program "A hombros de gigantes".

LISTEN TO THE INTERVIEW ON RADIO NACIONAL DE ESPAÑA (RNE) HERE (SPANISH LANGUAGE)



### Paraplégicos avanza en soluciones a la lesión medular

Publicado por: Redacción en Portada 5 enero, 2023



El Hospital Nacional de Paraplégicos participa, junto con otras seis instituciones y empresas de seis países europeos, en un proyecto dotado con 3,5 millones de euros, llamado Piezo4Spine, 'Matriz terapéutica dirigida a receptores Piezo: Un actuador multifactorial revolucionario para reparar la médula espinal lesionada'.

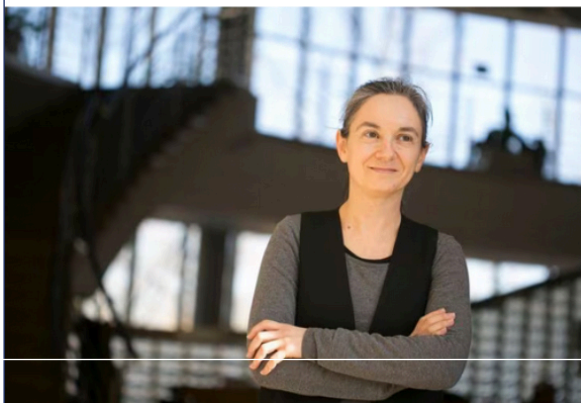


24/1/23, 14:24 Paraplégicos participa en una investigación del CSIC sobre estudio de la nanotecnología para reparar lesiones medulares

### LACERCA.com

### Paraplégicos participa en una investigación del CSIC sobre estudio de la nanotecnología para reparar lesiones medulares

Fuente: La Cerca / EP - Martes, 24 de enero de 2023



## PODCAST & BLOG

Further amplifying the project's reach, a recent episode of the "**BioteXperten**" podcast, produced by our partner acib GmbH, featured an in-depth conversation with María C. Serrano, where she shared both professional and personal insights into the project's innovative approach and the challenges faced.

Complementing these efforts, Katharina Schwaiger and Martin Walpot of acib GmbH penned an informative blog article, offering a comprehensive overview of the project to the public.

READ MORE HERE

<https://acib.at/repairing-spinal-cord-injuries-with-nanotechnology/>



LISTEN TO THE PODCAST HERE

# NEWS & ANNOUNCEMENTS

11-14  
November  
2024



The European Summit of Industrial Biotechnology (esib) is organized by our partner acib GmbH and takes place from 11<sup>th</sup> to 14<sup>th</sup> November 2024 in Graz, Austria. The esib is one of the biggest Biotech-Fairs in Europe with 500-600 participants from over 30 countries. The

conference not only covers science but also focusses on industrial needs and hopes, economic demands, funding resources or political aspirations and still leaves space for networking and recreation.

[www.esib.at](http://www.esib.at)

## PIEZO4SPINE NEWSLETTER EDITORIAL TEAM

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MORE INFO & NEWS

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