ACTUATED NANOPARTICLES UNLOCK ENDOTHELIAL BARRIERS

ENVIRONMENTALLY SUSTAINABLE FABRICATION OF PIEZOELECTRIC NANOFIBERS

BIOMATERIALS FORUM

OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

SECOND QUARTER 2025 • VOLUME 47, ISSUE 2

ALSO INSIDE

CONGRESS DEBATES BIOMEDICAL RESEARCH BUDGETS

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BIOMATERIALS FORUM

The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 47, Issue 2

SPECIAL INTEREST GROUP REPORTERS

If interested in filling a vacancy above, please reach out to your SIG Chair. Contact information can be found on individual SIG pages as found **here**.

SFB CALL FOR NOMINATIONS

The SFB Awards, Ceremonies and Nominations Committee is currently accepting nominations for all 2026 awards and for the positions of President-Elect and Member-at-Large for the 2026-2027 term.

CALL FOR NOMINATIONS 2026-2027 TERM:

- President-Elect
- Member-at-Large

DEADLINES:

- AWARDS: Wednesday, September 17, 2025
- OFFICERS: Wednesday, September 24, 2025

2026 AWARDS:

- Founders Award
- C. William Hall Award
- The SFB Award for Service
- Technology Innovation and Development Award
- Community Impact Award
- Mid-Career Award
- Young Investigator Award
- Clemson Award for Basic Research
- Clemson Award for Applied Research
- Clemson Award for Contributions to the Literature
- Outstanding Research by a Hospital Intern, Resident or Clinical Fellow Award
- Student Awards for Outstanding Research
  - *PhD, Masters, Undergraduate Categories*

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www.biomaterials.org/AWARDS

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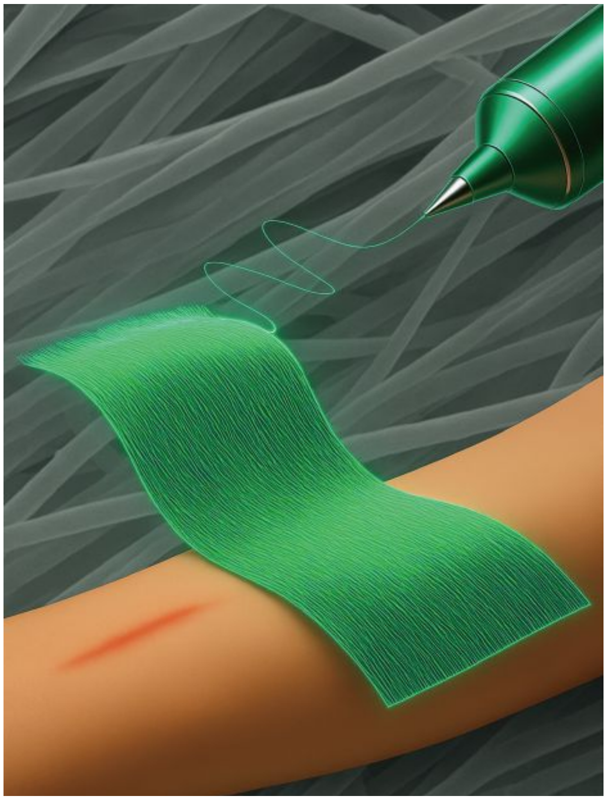


ON THE COVER

An environmentally sustainable electrospinning process for fabricating biodegradable piezoelectric nanofibers, which serve as a self-stimulated medical implant to enhance tissue regeneration. Image credit: Zhiming Li, PhD student, Nguyen Lab, University of Connecticut.

From the Editor

By Roger Narayan, MD, PhD, Biomaterials Forum Executive Editor

Welcome to the Second Quarter issue of the Biomaterials Forum! In her President's Letter, Professor Joyce Y. Wong thanks Shena Seppanen for her service as the society's Assistant Executive Director, as well as Dr. Natalie Artzi and Dr. Kaitlyn Sadtler for their efforts as organizers of the successful 50th Annual Meeting in Chicago. Professor Wong also congratulates NC State, Vanderbilt, the University of Florida and Boston University for their Biomaterials Day events. The president's note also highlights mechanisms for becoming involved in advocacy and engagement through participation in Biomaterials Day, sharing biomaterials-related stories with the public and contributing to the Society's committees.

The AIMBE update highlights the launch of the Friends of NIBIB (FoNIBIB) Coalition, which will provide advocacy activities for the National Institute of Biomedical Imaging and Bioengineering (NIBIB). Additionally, the update includes information on accessing the AIMBE Advocacy Toolkit, which provides guidance on effective communication with legislators. The student news highlights recent events, including the Student Luncheon at the 2025 Annual Meeting and the Biomaterials Day events, and provides information on how students can host a Biomaterials Day event.

This issue features two articles that showcase the research advances being made by members of the society. Professor Juan Beltran-Huarac at East Carolina University explores the use of safe-by-design superparamagnetic iron oxide nanoparticles to enhance the delivery of drugs that are used for cancer treatment via magneto-mechanical actuation. The second feature by Zhiming Li, Dr. Nitu Bhaskar, and Professor Thanh Duc Nguyen at the University of Connecticut describes a more environmentally sustainable method for electrospinning biodegradable nanofibers made from poly(L-lactic acid) (PLLA). This piezoelectric material can generate electrical signals when exposed to mechanical stress for use in neural and orthopedic medical implants.

Professor Guillermo Antonio Ameer shares the Member News section, which recognizes significant achievements, including Professor Nicholas Peppas receiving the prestigious Kabiller Prize in Nanoscience and Nanomedicine, Professor Katharina Maisel receiving the Outstanding Young Engineer award from the Maryland Science Center, Professor Guillermo Ameer serving as inaugural director of the Querrey Simpson Institute for Regenerative Engineering at Northwestern University, Professor Ali Khademhosseini receiving the Materials Research Society Mid-Career Researcher Award, Professor Ahmed El-Ghannam receiving the 2025 Innovation Award from the University of North Carolina at Charlotte, Professor Joel Bumgardner giving an invited talk at the Institute of Physiology of Czech Academy of Sciences, and Professor Aliasger Salem receiving the 2025 Regents Award for Faculty Excellence.

In Industry News, Dr. Subra Guna provides an overview of biomaterials global market trends, including impressive growth in the polymeric and implantable biomaterial market segments. In Government News, Dr. Dawn Beraud describes significant changes to the budgets for the National Science Foundation, the National Institutes of Health and the Advanced Research Projects Agency for Health in the president's budget, as well as the process by which the appropriations bills for the coming fiscal year are passed into law. In addition, recent efforts by the Joint Associations Group (JAG) on Indirect Costs to develop a new process for research organizations to cover their essential research costs are described.

Please feel free to contact me at roger_narayan@ncsu.edu if you would like to share biomaterials research, education and translation activities that may be of interest to the Society For Biomaterials community. Your submission of news items, updates and cover images is always welcome.

From the President

By Joyce Wong, SFB President

Dear SFB Members,

In these uncertain times, what gives me hope is the tremendous strength and resilience of our biomaterials community. The excitement and energy at our 50th Annual Meeting in Chicago were truly inspiring (special thanks to our program chairs Dr. Natalie Artzi and Dr. Kaitlyn Sadtler, as well as our dedicated SFB staff). I was especially moved by the enthusiasm of our young trainees, who are the future of our field and whom we must support and encourage – now more than ever.

Special Thanks

It is with mixed emotions that I announce that Shena Seppanen – who has worked with many of you over the past seven years – is leaving SFB effective July 1, 2025. Shena has played so many roles at SFB – starting as Membership Coordinator, and rapidly being promoted to Assistant Executive Director. We are grateful for Shena's broad support of our membership and for her efforts in strengthening key areas across SFB, including our student chapters, Young Scientist Group, Special Interest Groups, and numerous committees. Her primary support has been for the Awards; Bylaws; Diversity, Equity & Inclusion; Education & Professional Development; Liaison; and Membership committees. As many of you know, she worked closely with Dan Lemyre to help align daily operations with long-term strategic goals. While we are sad to see Shena go, we are excited to support her as she embarks on the next stage of her career.

Looking Ahead: 2026 Annual Meeting

We are already preparing for our next gathering, "*Biomaterials at the Crossroads: Connecting Science, Industry, and Innovation*," scheduled for March 25-28, 2026, in Atlanta, organized by co-chairs Dr. Angela Throm (Medtronic) and Dr. Susan Thomas (Georgia Institute of Technology). Please look out for emails about opportunities to offer input in the planning process.

How You Can Engage and Make a Difference

Federal funding for science faces significant challenges, making your advocacy and engagement more important than ever. Here are actionable ways to get involved:

1) Participate in or start a Biomaterials Day

- **Host or attend a regional Biomaterials Day** to connect with peers, share research and build collaborations. Consider inviting the broader community. **Please note that applications for 2026 Biomaterials Day funding are due Monday, September 29, 2025.** Learn more and apply here.
- **Update or start your SFB student chapter** by submitting this form. If your school is not listed, email info@biomaterials.org for assistance.

2025 Biomaterials Days Highlights:

- **NC State** focused on the role of textiles in biomaterials, bringing together trainees, faculty and industry experts to showcase research and foster collaboration.
- **Vanderbilt** hosted "*Biomaterials at All Scales: Nano, Micro, and Macro,*" uniting the mid-South community for interdisciplinary exchange and networking.
- **University of Florida**'s "*Building Tomorrow with Biomaterials Today*" promoted innovative engineering and featured academic, industry and student presentations.
- **Boston University** launched its Inaugural Biomaterials Day to engage undergraduates in biomaterials research and community building.

2) Share your biomaterials-related stories with the general public

- Amplify your impact by sharing your foundational and translational research on LinkedIn (@Society For Biomaterials), Facebook (@Society for Biomaterials) or other social media using **#StandUpForBiomaterials**. This will help demonstrate the importance of biomaterials and federal investment in science and engineering to a broader audience.
- Consider engaging with the general public by contributing to local events such as *Lectures on Tap*.

3) Get involved with SFB committees

- Engage with our many committees that are working hard to add value to our members. Be on the lookout for opportunities to engage.

Together, we are strong, and together, we can support each other and advance the promise of biomaterials, especially during these uncertain times.

Yours in solidarity and with gratitude,

Joyce Y. Wong, PhD
Professor of Biomedical Engineering and Materials Science & Engineering, Boston University
President of Society For Biomaterials

AIMBE Updates

AIMBE NOMINATIONS CLOSING SOON

AIMBE Fellows and Council Representatives have received nomination instructions. If you haven't started yet, now is the time to act. Help elevate leaders from across your network, professional society and institution.

Contact election@aimbe.org with any questions.

AIMBE LAUNCHES NEW ADVOCACY COALITION FOR NIBIB

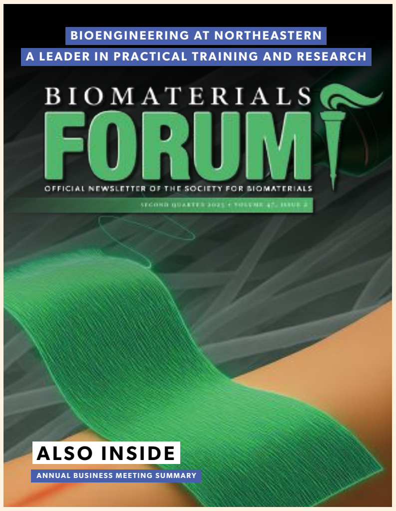
AIMBE is proud to launch the Friends of NIBIB (FoNIBIB) Coalition to support and advocate for the National Institute of Biomedical Imaging and Bioengineering (NIBIB) and its initiatives. Priorities of FoNIBIB include advocating for continued investment in NIBIB through the congressional appropriations process, promoting the impact of NIBIB's groundbreaking research, engaging policymakers to raise awareness of NIBIB's crucial role within the medical and biological engineering landscape, as well as advocating for NIBIB as a standalone institute at the NIH. The first FoNIBIB event took place on July 18, 2025, and will host congressional staffers for a visit to the NIH campus to tour NIBIB-funded labs and view live demonstrations of cutting-edge research supported by the Institute. The day will conclude with a leadership roundtable between FoNIBIB coalition members and NIBIB leadership to align priorities and discuss strategic collaboration. Click here to learn more about FoNIBIB coalition members and its planned activities.

AIMBE ADVOCACY RESOURCES

AIMBE offers a comprehensive suite of advocacy resources to support researchers in engaging with policymakers and promoting the advancement of medical and biological engineering. These resources include tools for contacting members of Congress, such as customizable letter templates and guidance on scheduling meetings or phone calls with lawmakers. Additionally, AIMBE provides up-to-date fact sheets on federal agencies like the NIH and NSF, as well as talking points to aid in effective communication with legislators. To access these tools and learn more about how to get involved, visit the AIMBE Advocacy Toolkit and see below for helpful resources from AIMBE.

- 2025 AIMBE Congressional Visits: Talking Points
- AIMBE Updated NIH Fact Sheet
- AIMBE Updated NSF Fact Sheet
- Share Your Grant Disruptions
- State Fact Sheets: NIH in Your State (United for Medical Research)
- State Fact Sheets: NSF in Your State (NSF)

CALL FOR COVER ART



WE WANT TO FEATURE YOUR EXCITING BIOMATERIALS ARTWORK ON THE COVER OF *BIOMATERIALS FORUM!*

Deadline: Accepted on a rolling basis.

Instructions: Please email artwork (digital images, artistic creations, etc.) to info@biomaterials.org, to the attention of the Executive Editor of the *Biomaterials Forum*. All artwork with biomaterials relevance that have not appeared as a *Forum* cover are welcome. Multiple submissions are permissible.

Description: Selected artwork will appear as the cover of a future issue of *Biomaterials Forum* along with a brief "On the Cover" description of the subject and name/affiliation of the creator.

Format: High-resolution electronic version in .gif, .tiff or .jpeg file format.

Student News

This summer, Society For Biomaterials Student Chapters are celebrating successes at the SFB Annual Meeting events and Biomaterials Days on their campuses earlier this year. We're also looking forward to helping more Student Chapters host Biomaterials Days to raise awareness of the field on campuses and in the community.

ANNUAL MEETING LUNCHEON DELIVERS DIVERSE OPPORTUNITIES AND PERSPECTIVES

At this year's Annual Meeting in Chicago, the Student Luncheon had more than 50 attendees and featured a panel of industry and academic speakers. Sponsored by TESco Associates, Inc., and University of Oregon Biomedical Engineering, the event provided students with valuable networking opportunities and diverse perspectives on career paths in biomaterials.

SFB Student Chapter members introduce the industry panel at the 2025 Annual Meeting

BIOMATERIALS DAYS PROMOTE THE FIELD

Thank you to the student chapters that are organizing Biomaterials Days. Their excellent work is raising awareness of the diversity and opportunity in our field while contributing to the community.

Boston University and NC State organized impressive Biomaterials Day programs and advertised their events, which featured student poster presentations, rapid fire talks and keynote addresses from faculty at their respective institutions.

Boston University students, faculty and guests gathered at BU's Biomaterials Day in April.

Biomaterials Days are regional meetings that provide scientific exchange, networking and educational opportunities for biomaterials scientists. These meetings are intended to promote the field and to encourage attendees to join the Society.

If you would like support hosting a Biomaterials Day with your student chapter, we encourage you to apply for a **Biomaterials Day grant**. SFB will provide grant recipients up to $2,500 in matched funds for Biomaterials Days in 2026.

Institutions hosting meetings must have active SFB Student Chapters in good standing to be eligible, and student involvement in planning and implementation of the event is highly encouraged. The application deadline is September 29, 2025. Watch this video to learn more about how to host a Biomaterials Day, and apply here.

MAGNETICALLY ACTUATED NANOPARTICLES UNLOCK ENDOTHELIAL BARRIERS FOR ADVANCED DRUG DELIVERY

By Juan Beltran-Huarac, PhD

Therapeutic targeting is considered one of the gold standards in cancer treatment. However, when a tumor grows beyond a critical size, its vascular system differentiates abnormally, creating a heterogeneous endothelial barrier.[1] In an event of tumor proliferation, this barrier undergoes highly coordinated disconnection and remodeling of cell junctions, inducing intercellular gaps within the tumor vasculature; this gives rise to the enhanced permeability and retention (EPR) effect. While EPR exploits the leakiness of the tumor vascular system, it faces challenges ascribed to tumor microenvironment dependence, which is not consistently observed in all solid tumor types, thus limiting drug transport to desired sites of action.

As an alternative to EPR, stimuli-responsive nanoparticles can be used to induce endothelial leakiness (NanoEL) through the disruption of adherens junctions. To regulate this response, safe-by-design superparamagnetic iron oxide nanoparticles (SPIONs) can be used, whose dormancy in cells can be remotely manipulated by alternating magnetic fields (AMFs). Indeed, there exists a link between the regulation of these junctions and acting filament remodeling, which can be elicited by actuated SPIONs. For this purpose, magnetic torques exerted on SPIONs are translated into non-thermic mechanical agitation through magneto-mechanical actuation (MMA).

MAGNETO-MECHANICAL ACTUATION OF ANISOTROPIC-SHAPED NANOPARTICLES

One of the keys to controlling the remote actuation of SPIONs is through their magnetic ordering, which can be correlated to their morphology. Anisotropic morphologies can induce large saturation magnetization, which creates strong local magnetic susceptibility gradients or field inhomogeneity, thus resulting in enhanced actuation. AMFs can exert pronounced torques on anisotropic SPIONs, which can lead to changes in cell structure and function. In this regard, AMFs were used to regulate TRAIL expression in transduced stem cells via MMA using SPIONs with cubic morphology.[2] MMA relies on the activation of single-domain SPIONs by low-frequency AMFs, which in turn affects organelles through stress-related signaling due to the realignment of particle magnetic moments.

Depending on the distribution of SPIONs across the cells, MMA can sensitize cells and dictate cytoskeletal reorganization based on intrinsic cell architecture. Primarily, the mechanical agitation originates from the change of the instant value of the applied magnetic field (B), which leads to the Brownian relaxation of the magnetic moments (μ) of SPIONs. This is achieved when both the system energy reaches its minimum and the μ and B vectors are co-directed and collinear. Brownian relaxation is favored when the radius of SPIONs is greater than a critical value (R_c), which is associated to the magnetic ordering of the material. The requirements hence to ensure particle-mediated energy deposition and efficient transduction of magnetic energy to mechanical agitation are that the effective radii of SPIONs be greater than R_c and that their morphologies depart from symmetrical configurations.

MAGNETIC CONTROL OF ENDOTHELIAL CELL RESPONSES

Endothelial cells are the first point of interaction with blood-contacting SPION-enabled products and are sensitive to intracellular forces, which can induce mechanical agitation through Brownian relaxation. In particular, forces mediated by SPIONs can deliver localized mechanical cues to endothelial cells, which allows for the control of certain signaling pathways, including the modulation of actin filament dynamics. In the endothelium, the ends of stress fibers and cortical F-actins anchor to adherens junctions, which can be used to tune the endothelial barrier response. In this sense, controlled alterations in the cytoskeleton organization induced by intracellular magnetic forces can specifically disrupt endothelial VE-cadherin junctions and, in turn, induce permeability.

This concept was proved on 2D cell culture models (mimicking the blood vessels) using monolayers of human umbilical vein endothelial cells (HUVEC), which were incubated with SPIONs and then treated with different magnetic doses. After adjusting particle concentration, incubation times and magnetic parameters (amplitude, frequency and exposure time), actin filament remodeling and subsequent VE-cadherin junction disruption were observed. This led to transient gaps in these monolayers, through which FITC-dextran was translocated. In the absence of AMFs, SPIONs were dormant within HUVEC cells with no detectable cell viability depletion.

Quantitative studies indicate that the endothelial permeability can reach values as high as 33 percent when 2-hour post-magnetic field treatment is used. This effect can be explained in terms of a magneto-mechanical transduced stress mechanism mediated by intracellular forces (Figure 1). This competes with the ARP2/3 complex process, under which the recruitment of α-catenin by the cytoskeleton takes place. This induces actin remodeling and spatial rearrangement from branches to bundle-like structures. This magneto-mechanical approach can open new avenues for targeted drug delivery into anatomic regions within the body for a broad range of disease interventions.

Magnetically Actuated Nanoparticles Unlock Endothelial Barriers for Advanced Drug Delivery

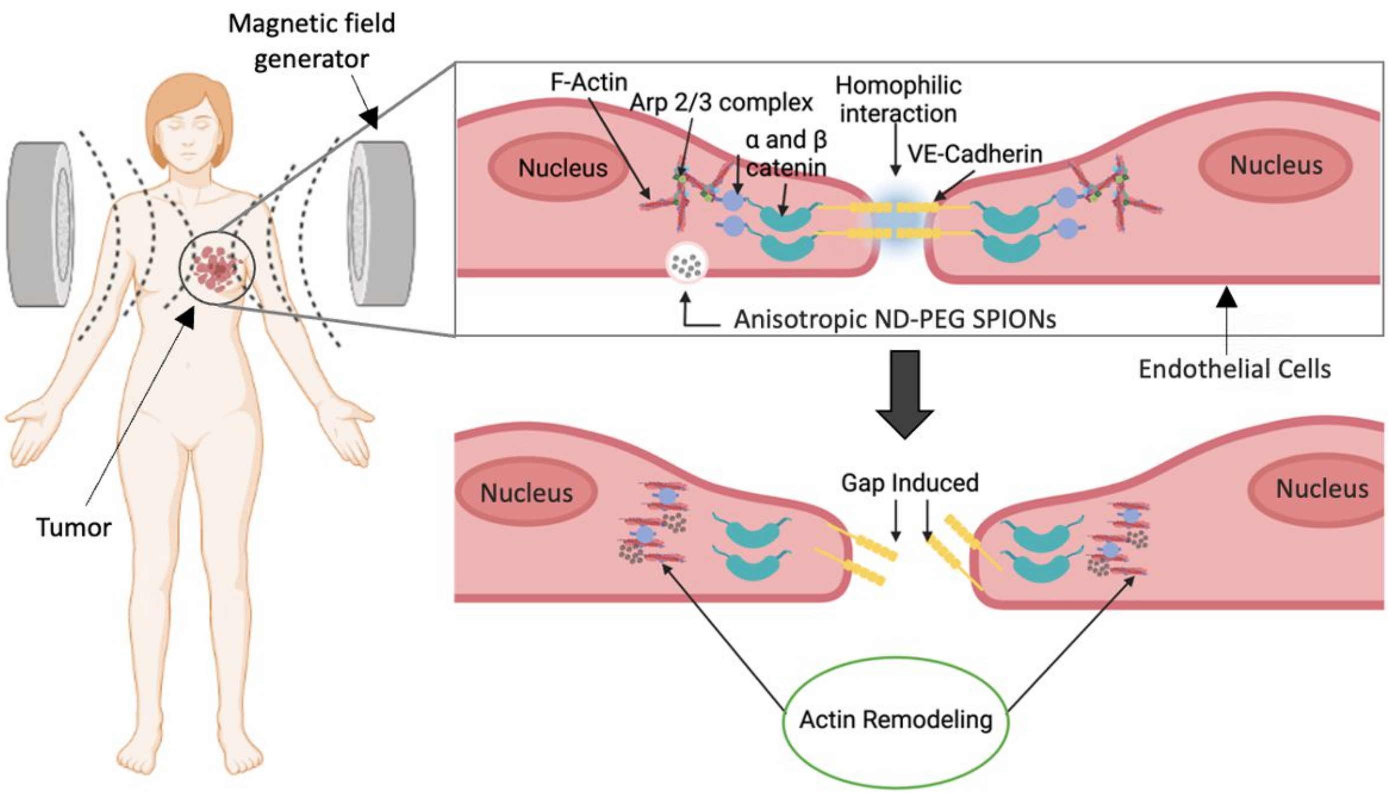


Figure 1. Schematics illustrating our magneto-mechanical approach to induce endothelial permeability via actin filament remodeling.

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Environmentally Sustainable Fabrication of Biodegradable Piezoelectric Nanofibers for Medical Implants

By Zhiming Li, Department of Biomedical Engineering, University of Connecticut; Nitu Bhaskar, Department of Mechanical Engineering, University of Connecticut; and Thanh Duc Nguyen, Institute of Materials Science, Polymer Program, University of Connecticut

Biomaterials, derived from organic and inorganic sources, are defined by their ability to interact with and replace damaged or destroyed host tissues. Both natural and synthetic biomaterials are the foundation of modern healthcare by facilitating tissue engineering, drug delivery and medical implants.[1] By imitating natural tissue structures, they facilitate cell adhesion and proliferation, allow for localized and prolonged drug release and improve implant efficacy. They must demonstrate suitable mechanical, chemical and biological properties, tailored for their specific function and biological context. Among various biomaterial processing techniques, electrospinning (ES) is notably effective for fabricating nanofibrous membranes (Figure 1A) that mimic the extracellular matrix (ECM) of native tissues. These nano- to micron-scaled fibers provide special membrane specifications because of their high membrane porosity and incredibly high surface-to-volume ratio. Additionally, their structural tunability enables them to act as drug carriers, allowing precise control over release rates and spatial localization.

Recently, piezoelectric polymers have received considerable attention among biomaterials due to their functional qualities that resemble natural tissues, such as bone, neuronal and muscular tissues.[2] The piezoelectric effect refers to a material's capacity to produce electrical signals when exposed to mechanical stress and vice versa. In tissue engineering, piezoelectric materials can transform normal bodily movements (e.g., breathing, walking) into low-level electrical signals that activate adjacent cells.[3,4] This facilitates cellular differentiation and tissue regeneration. Standard implants often necessitate surgical extraction, whereas biodegradable piezoelectric scaffolds undergo natural degradation concurrent with tissue formation — eliminating the need for invasive removal surgery and facilitating cellular ingrowth and tissue remodelling. These scaffolds, in conjunction with their piezoelectric properties, offer both structural reinforcement and active healing stimulation. The Nguyen lab at the University of Connecticut is actively using poly(L-lactic acid) (PLLA) nanofibers by electrospinning technology to develope biodegradable piezoelectric nanofibers for orthopedic[3-5] and neural implants.[6-9]

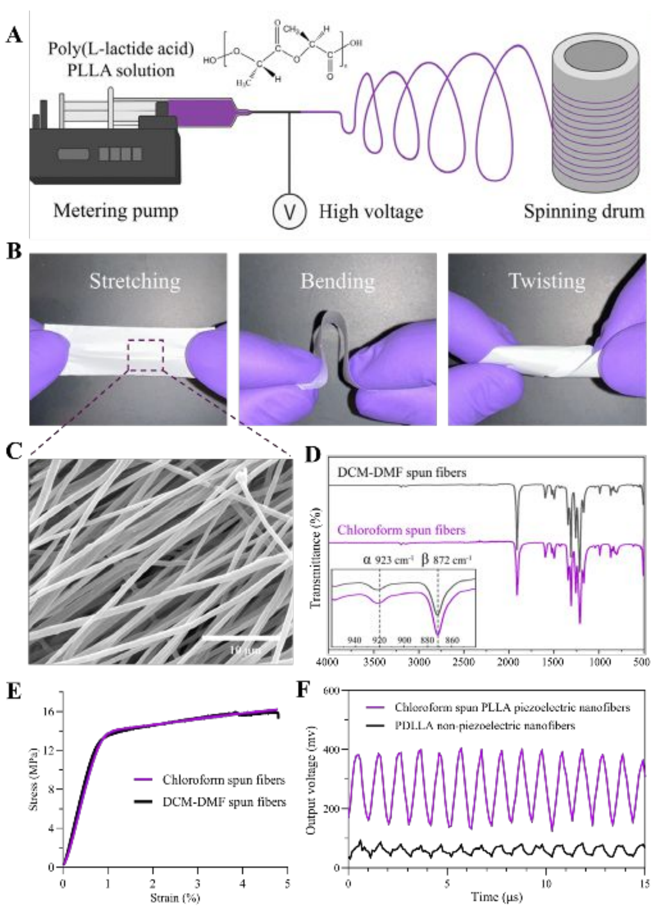
Since this technology uses a limited number of solvents, including trifluoroethanol (TFE), dichloromethane (DCM) and dimethylformamide (DMF), and solvent mixtures that are effective in dissolving water-insoluble polymers, it is frequently far from a green and environmentally friendly process. Therefore, it always has problems, such as high flammability, toxicity, difficult disposal, energy-intensive synthesis and difficulty in completely removing it from the final fibers. Large-scale usage and disposal of these chemicals provide significant environmental and safety risks, and traces of these solvents may persist in the implant and could cause toxicity or inflammation. Many companies are reluctant to include the ES approach into their manufacturing processes when it comes to commercializing items because it requires extensive knowledge about handling solvents and how to properly dispose of them, which is also quite expensive.[10] The U.S. Food and Drug Administration has now limited the use of many of the most widely used solvents in the electrospinning industry, including industrial-grade organic solvents such as DMF.

To address this limitation, herein, we present a more sustainable alternative by using chloroform as a single solvent for electrospinning PLLA piezoelectric nanofibers, compared to conventional binary solvent systems (DMF mixed with DCM), which need exact ratio control to ensure stable fiber synthesis.[5-7,11] Although it is not completely risk-free, chloroform is not currently classified as a Class 1 solvent under regulatory rules and is thought to have lesser systemic toxicity than the solvents described above. Additionally, when handled under regulated settings, it is easier to evaporate and remove from the final product, which makes it more acceptable for use in medical manufacturing. To assess this approach, we compared chloroform-based ES with the traditional DCM-DMF (4:1 v/v) ES system using identical parameters: G22 needle, 2 mL/h flow rate, 4000 rpm drum speed, and 25–30 percent humidity. After the overnight curing process, scanning electron microscopy revealed comparable fiber morphologies and diameters: 1.38 ± 0.15 μm (chloroform) vs. 1.31 ± 0.23 μm (DCM-DMF) as seen in Figures 1B–1C. The Fourier transform infrared (FTIR) spectroscopy spectra showed characteristic peaks for the β phase at 872 cm^{-1} and the α phase at 923 cm^{-1} (Figure 1D). The two types of fibers exhibited similar β-phase ratios [F(β)], with values of 55.43 ± 3.8 percent for chloroform-spun fibers and $56.78 \pm 2.4\%$ for DCM–DMF–spun fibers. Additionally, the chloroform spun fibers showed comparable mechanical strength with a yield stress of 14.34 ± 0.25 MPa and a Young's modulus of 613.87 ± 0.15 MPa, which is comparable to those DCM-DMF spun fibers (14.48 ± 0.13 MPa, 615.45 ± 0.24 MPa) (Figure 1E). Finally, piezoelectric functionality was validated by sandwiching the fibers with 1 × 1 cm aluminum electrodes, encapsulated in

Environmentally Sustainable Fabrication of Biodegradable Piezoelectric Nanofibers for Medical Implants

polyimide and copper tape, and applying 1 MHz ultrasonic waves. Chloroform-spun fibers produced 272.5 ± 82.55 mV (peak-to-peak), markedly exceeding non-piezoelectric PDLLA controls (49.3 ± 12.75 mV) (Figure 1F). All these results confirm the feasibility of using chloroform as a safer, scalable solvent system without compromising fiber quality or functionality.

Chloroform is a single-solvent system that makes fabrication easier by avoiding the exact solvent mixing process and severe environmental control. This promotes safer laboratory procedures, lowers operator risk and enhances process uniformity. Chloroform provides a more sustainable and scalable alternative to manufacturing the nanofibers applied in medical implants, even though proper ventilation and disposal are still necessary. Ultimately, choosing these solvents first can and ideally will be a matter of habit. After all, there is a growing push for ES-manufacturing that is sustainable, safe and considerate of the environment. The practical potential of piezoelectric materials for clinical translation is increased by its harmony of processability, functionality and safety.



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Member News

By Guillermo Antonio Ameer, ScD

Nicholas Peppas, ScD.

Northwestern University's International Institute for Nanotechnology (IIN) has announced the recipients of the 2025 international Kabiller awards. The biennial awards recognize three top scholars — one pioneer and two rising stars — at the cross-section of nanoscience, technology, biology and medicine.

Nicholas Peppas, the Cockrell Family Regents Chair in Engineering and Professor at the University of Texas at Austin, will receive the $250,000 Kabiller Prize in Nanoscience and Nanomedicine, the world's largest monetary award in the field. The awardees will be honored at the Kabiller Prize Dinner on Oct. 14, 2025, in Chicago, and will present their work as keynote speakers at the 2025 IIN Rosemary Schnell Symposium on Oct. 15 in Evanston, Illinois. The symposium unites researchers, students and industry leaders to explore the latest advances in nanoscience and nanomedicine.

Katharina Maisel, Ph.D. Associate Professor, Department of Bioengineering, Robert E. Fischell Institute for Biomedical Devices, University of Maryland

Dr. Katharina Maisel has been awarded the Maryland Science Center's 2025 Outstanding Young Engineer award for her groundbreaking contributions to immunoengineering and drug delivery. Her lab uses in vitro modeling, nanotechnology and immunoengineering approaches to study and develop treatments for diseases at mucosal surfaces. This work creates crucial fundamental knowledge about stromal cell involvement in disease pathology and leads to novel targets and design criteria for therapeutics.

The OYE award is given to a professional age 35 or younger who works in academia, or 40 or younger for those in other sectors. Honorees are selected by members of the Maryland Science Center's Scientific and Education Advisory Council.

"The Maryland Science Center inspires curiosity and exploration, and shares the process and joys of the scientific process," said Mark J. Potter, President and CEO of the Maryland Science Center. "Our annual STEM awards honor that process by recognizing young professionals, students, and educational advocates."

Guillermo Ameer, Sc.D., Professor, Department of Biomedical Engineering, Department of Surgery, Northwestern University

Northwestern University Trustee Kimberly K. Querrey ('22, '23 P) has made a $10 million gift to create and enhance the Querrey Simpson Institute for Regenerative Engineering at Northwestern University (QSI RENU), bringing her total giving to the institute to $35 million.

The institute's inaugural director is Guillermo Ameer, the Daniel Hale Williams Professor of Biomedical Engineering and Surgery at Northwestern, who has dual appointments in McCormick and Feinberg. Ameer is a leader in regenerative engineering, biomaterials, additive manufacturing for biomedical devices, controlled drug delivery and bio/nanotechnology for therapeutics.

Member News Cont.

The new institute will advance the development of medical tools that empower the human body to heal, focusing on the regeneration or reconstruction of various tissues and organs, such as the eyes, cartilage, spinal cord, heart, muscle, bone and skin. The Launch event took place in the form of a Symposium on Translational Regenerative Engineering on April 29, 2025, where Drs. Laura Niklason and Karen Christman were invited keynote speakers.

Ameer and collaborator John A. Rogers — the Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, Biomedical Engineering and Neurological Surgery — recently co-led a new study published in the journal Nature titled "A non-contact wearable device for monitoring epidermal molecular flux." The paper introduces the first wearable device to gauge health by sensing gases emitted from and absorbed by the skin. By measuring water vapor, carbon dioxide and volatile organic compounds, the new technology offers insights into infections, wound healing, hydration and chemical exposure.

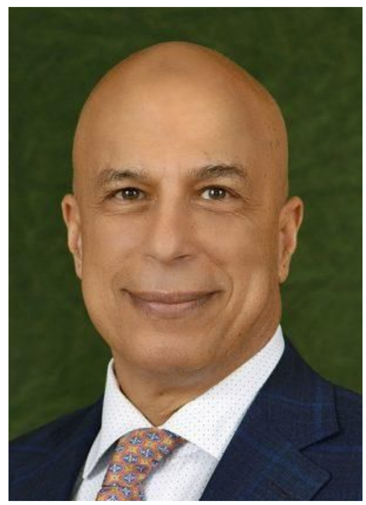
Ali Khademhosseini, PhD

Ali Khademhosseini, Ph.D., Director and CEO of the Terasaki Institute for Biomedical Innovation, was awarded the 2025 Materials Research Society (MRS) Mid-Career Researcher Award, recognizing his global leadership and pioneering contributions to biomaterials science and tissue engineering.

The award was formally presented to Khademhosseini in April at the MRS Spring Meeting in Seattle, Washington, where he delivered a keynote address on recent advances in engineered tissues for regenerative medicine.

The MRS Mid-Career Researcher Award acknowledges Khademhosseini's groundbreaking contributions to biomaterials science and tissue engineering, particularly his pioneering work developing innovative materials and technologies for regenerative medicine applications.

"I am deeply honored to receive this recognition from the Materials Research Society," said Khademhosseini. "This award reflects the collaborative efforts of many talented researchers I've had the privilege of working with throughout my career. At TIBI, we remain committed to pushing the boundaries of materials science to create solutions that address critical healthcare challenges."



Ahmed El-Ghannam, PhD

Ahmed El-Ghannam, Ph.D., Professor, Department of Mechanical Engineering and Engineering Science, University of North Carolina at Charlotte, received the university's 2025 Innovation Award in Ceramic Powder Preparation for Additive Manufacturing, Materials Science and Engineering. He invented a new additive manufacturing method of a novel bioactive silicon carbide medical implant that enables bone tissue reconstruction, nerve regeneration and controlled drug delivery to treat neuropathy in cancer patients.

The innovative 3D printing method of SiC uses water as a binder in a powder bed binder jet printer. NASA and the DOD are acknowledged for the financial support for the research projects.

Member News Cont.

Joel D Bumgardner, Ph.D.

Joel D Bumgardner, Ph.D., Professor, Biomedical Engineering Department, University of Memphis, gave an invited talk titled "Chitosan Nanofibers: Electrospinning & the Promise for Guided Bone Regeneration" at the Institute of Physiology of Czech Academy of Sciences in Prague, Czech Republic, in May. The talk was part of a research visit to Dr. Lucie Bačáková's Biomaterials and Tissue Engineering Lab. Bumgardner visited the lab with graduate students Alex Bryan and Nikken Malboeuf of the U of M-UTHSC Joint BME Program to investigate novel chitosan-based membranes for wound healing and skin regeneration. The project is supported by joint funding from the Czech Academy of Sciences and the University of Memphis.

Aliasger Salem, Ph.D.

Aliasger Salem, Ph.D., Professor, College of Pharmacy, and Lyle and Sharon Bighley Endowed Chair and Professor of Pharmaceutical Sciences, University of Iowa, received the 2025 Regents Award for Faculty Excellence. He was also part of a multi-PI team that received a grant for $2,846,242 from the National Eye Institute at the National Institutes of Health for the project "Modulation of ocular surface innate immunity and corneal wound healing." Salem, together with S.M.A.M. Hashmi, L.R.J. Chakka was also issued U.S. patent 12,232,945 for a Preloaded DMEK holder.

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A.K. Salem. Selenium is an essential nutrient named after the Greek goddess of the Moon – crucial to health, it may help prevent and treat cancer. The Conversation. 2025.

A.K. Salem. Meet phosphine, a gas commonly used for industrial fumigation that can damage your lungs, heart and liver. The Conversation. 2025.

These articles talk about the importance of federal funding for biomedical research:

A.K. Salem. How much does scientific progress cost? Without government dollars for research infrastructure, breakthroughs become improbable. The Conversation. 2025.

A.K. Salem. Medical research depends on government money – even a day's delay in the intricate funding process throws science off-kilter. The Conversation. 2025.

CALLING ALL BOOKWORMS!

If you'd like to contribute a review of your recent favorite read to the ***Biomaterials Forum***, send it for consideration to the Editor at ***Roger_narayan@ncsu.edu***. If it's approved, it will be published in a future Forum Book Review column!

Industry News

By Subra Guna, PhD

The biomaterials industry experienced gains in the first part of 2025, with notable gains in polymeric and implantable biomaterials. North America continues to lead the industry, but the Asia Pacific region benefited from rising biotech demands and healthcare infrastructure. Here are the industry highlights for Q1 and Q2 2025, plus a look ahead toward the rest of the year:

MARKET GROWTH AND FINANCIAL HIGHLIGHTS

- The global biomaterials market is experiencing robust growth in 2025. Market size estimates for 2025 range from $178.5 billion to $192.43 billion, with projections to reach between $523.75 billion and $814.7 billion by 2034–2035, reflecting a compounded annual growth rate (CAGR) between 11.8 percent and 14.8 percent.[1, 2]

- North America continues to dominate the market, with the U.S. biomaterials sector expected to grow from $46.85 billion in 2024 to $144.21 billion by 2034, at a CAGR of 12 percent.[1]

- Asia Pacific is emerging as a key growth region, driven by expanding healthcare infrastructure, rising demand for advanced treatments and significant investment in biotechnology.[2]

KEY MARKET SEGMENTS AND TRENDS

- **Polymeric Biomaterials**: Polymeric materials are leading the market due to their versatility, biocompatibility, and adaptability for applications such as implants, drug delivery, and tissue engineering.[2, 3].

- **Implantable Biomaterials**: This segment is growing rapidly, with market size increasing from $144.1 billion in 2024 to $165.43 billion in 2025 (CAGR 14.8 percent). Growth is driven by advances in tissue engineering, regulatory progress, and the introduction of biodegradable and smart biomaterials.[4]

- **Application Areas**: Biomaterials are widely used in orthopedics, cardiology, dentistry, wound management, and regenerative medicine. The intersection with nanotechnology and 3D printing is opening new avenues for drug delivery and patient-specific implants.[2, 4]

INDUSTRY PERFORMANCE: Q2 2025 SNAPSHOT

- Companies like Valmet reported that their Biomaterial Solutions and Services segment achieved revenues of 973 million euros in Q2 2024, with an operating margin of 9.8 percent for the same period. Q1 2025 revenue was 846 million euros, indicating sustained demand and profitability.[5]

- Key players in the industry include Medtronic, Johnson & Johnson, BASF SE, Corbion, Evonik Industries, Stryker Corporation, Abbott Laboratories, DuPont and 3M. These companies leverage extensive R&D, broad product portfolios, and strategic partnerships to maintain market leadership.[2]

INNOVATION AND RESEARCH FOCUS

- The industry is seeing significant innovation in biocompatibility, bioresorbable materials, and smart biomaterials that respond to physiological conditions.[4]

- Conferences and forums in 2025 are emphasizing the integration of digital transformation, personalized medicine, and the development of next-generation materials for tissue engineering and regenerative medicine.[2, 6]

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Government News

By Dawn Beraud, PhD

UNDERSTANDING THE FEDERAL BUDGET PROCESS

Each year, the federal budget process begins with the President's Budget Request, typically released in the spring. This proposal outlines the administration's funding priorities for the upcoming fiscal year, including recommended levels for science agencies such as NIH, NSF and others. While this document signals the White House's policy goals, it is not binding. Only Congress has the power to appropriate federal funds. For biomedical research, the FY26 President's budget proposes:

National Science Foundation (NSF): $3.9 billion, down from $9.06 billion enacted in FY25, which represents a 57 percent cut

National Institutes of Health (NIH): $27.9 billion, a 40 percent reduction from FY25 levels, paired with a proposed restructuring of the agency

Advanced Research Projects Agency for Health (ARPA-H): $945 million, down 37 percent from FY25.

Each chamber develops its own appropriations bills, which must then be debated, passed and ultimately reconciled into a single version that both the House and Senate agree on. This agreement is often difficult to reach and may involve negotiations between chambers and party leadership.

The final bills must be passed by both chambers and signed by the President before the fiscal year deadline of Sept. 30, 2025, or Congress must pass a continuing resolution (CR) to avoid a shutdown.

Three additional budgetary tools are important in the current political climate:

Reconciliation is a special process that allows certain budget-related bills (usually involving spending, revenue or the debt limit) to pass the Senate with a simple majority, bypassing the filibuster. This has been used for major policy changes but cannot be used for discretionary funding like NIH or NSF.

Rescissions refer to the cancellation of previously approved budget authority. Congress or the president may propose rescissions, but they must be approved by Congress.

Impoundment occurs when the president withholds or delays spending of funds that Congress has already appropriated. However, under the Impoundment Control Act, the president must seek congressional approval to permanently withhold funds. This is especially relevant now, as scrutiny around executive authority over federal funds continues to grow.

POLICY UPDATES TO INDIRECT COST CAPS

Earlier this year, the Trump Administration announced a 15 percent facilities and administrations (F&A) cost cap for new NIH grants, and later, for grants administered by NSF, DOD and DOE. While the courts continue to halt implementation of this policy, the community is preparing for how institutions may negotiate indirect costs going forward. To prepare for potential policy changes, 10 national organizations formed the Joint Associations Group (JAG) on Indirect Costs, a community-based approach developing new models for funding of indirect costs on federal research grants. JAG is led by former White House Office of Science and Technology Policy Director Dr. Kelvin Droegemeier, professor and special adviser to the Chancellor for Science and Policy at the University of Illinois, Urbana-Champaign.

After receiving input from the community and conducting a thorough evaluation of the current indirect cost reimbursement model and potential replacements, JAG released ***two*** government-wide funding models aimed to make F&A costs simpler and more transparent. Both models create an auditable and transparent process for covering essential research costs. They fund the actual cost of research, linking costs to individual projects and project-based needs, eliminating the periodic F&A rate negotiation process, and eliminating multiple rates (e.g., on/off campus).

Model I calculates F&A rates based on the type of research being conducted and a fixed percentage of the total budget based on historical actual recovery from audited public data. Reimbursement rates would be higher for projects requiring labs that handle chemicals or biological samples, for example.

In Model II, costs are structured to reflect actual resources utilized plus a space assessment process to set rates for facilities costs. Under the second proposed model, institutions would submit a detailed accounting of every expense incurred for each research project under eight different categories. All would be considered direct costs. A ninth, catch-all category called general research operations (GRO) would cover expenses that cannot be broken out by project.

Both models would require significant culture change at institutions administering federal grants, with the goal of recouping all incurred costs. In the coming weeks, JAG plans to hone the models into a single proposal which will be presented to Congress and the Executive Branch. Learn more about the two F&A models, here. Test the models and share input here. General feedback on the process can be shared here.

Government News

SENATE APPROPRIATIONS HEARING WITH NIH DIRECTOR, DR. JAY BHATTACHARYA

At the June 10, 2025, Senate Appropriations Subcommittee on Labor, Health and Human Services, Education, and Related Agencies Hearing, NIH Director Dr. Jay Bhattacharya faced bipartisan scrutiny over the Trump administration's proposed 40 percent budget cut and the termination or delay of more than 2,300 research grants totaling $4.9 billion. Sens. Tammy Baldwin (D-WI), Susan Collins (R-ME) and Dick Durbin (D-IL) cited disruptions to research in Alzheimer's, cancer, HIV and maternal health, pointing to halted trials and frozen awards. Bhattacharya acknowledged that many terminations stemmed from institutional disputes but said efforts were underway to resolve them.

Lawmakers raised further concerns about a proposed "forward funding" policy that would frontload multi-year grant awards, placing billions in escrow and reducing current-year research activity. Baldwin warned this could result in 15,000 fewer grants next year and a $7 billion drop in research access atop the proposed $18 billion topline cut. Sens. Patty Murray (D-WA) and Brian Schatz (D-HI) argued that this shift, along with growing influence from political appointees and DOGE, threatens NIH's scientific integrity and global standing. Bhattacharya defended the reforms as enhancing transparency and oversight, while urging congressional collaboration to prevent further disruption.

The proposed 15 percent cap on indirect costs also drew criticism. Collins warned it would disproportionately hurt smaller institutions and drive researchers abroad. While citing active litigation and declining to comment directly, Bhattacharya acknowledged inequities in the current system, where elite institutions receive up to 70 percent of grant funds in indirect costs. He expressed interest in reforms to broaden access, referencing the IDeA program as a model. In response to questions from Sens. Katie Britt (R-AL), Jeff Merkley (D-OR) and Murray, Bhattacharya reaffirmed NIH's commitment to research on health disparities and maternal mortality, and emphasized a continued focus on measurable health outcomes. He also pledged greater transparency around DOGE's role in funding and reaffirmed his commitment to peer-review integrity amid political pressures.

SENATE APPROPRIATIONS HEARING WITH HHS SECRETARY ROBERT F. KENNEDY JR.

At the May 14, 2025 Senate Committee on Health, Education, Labor, and Pensions Hearing, HHS Secretary Robert F. Kennedy Jr. outlined a new direction for the department, describing the U.S. as "the sickest developed nation" despite $4.5 trillion in annual healthcare spending. He emphasized prevention-focused reforms targeting chronic disease, addiction and environmental hazards, while pledging to preserve legacy programs like Medicare, Medicaid and Head Start. Kennedy also highlighted initiatives to expand access to care in underserved areas, enhance food safety and reduce reliance on pharmaceutical interventions through investments in healthier lifestyles and community-based care.

Sen. Bernie Sanders (I-VT) criticized reductions to NIH funding, noting the termination of more than 1,600 grants and a $2.7 billion rollback in the first quarter of 2025. He warned that cuts to research on cancer, Alzheimer's and diabetes would have long-term consequences, and also condemned reductions to vaccine and global health programs. Murray warned that slashing public health and biomedical research capacity would undermine national readiness for future health threats. Sen. Rand Paul (R-KY) questioned NIH spending on certain behavioral and health equity studies and argued that the agency should refocus its priorities. Sen. Bill Cassidy (R-LA) pressed Kennedy on how NIH could remain competitive globally despite leaner budgets.

Kennedy emphasized the administration's intent to reduce reliance on animal testing, stating that HHS is accelerating its use of AI-based toxicology models to replace traditional trials. He claimed these tools could shorten clinical timelines and improve cost-effectiveness without compromising scientific integrity. On biosecurity, Kennedy confirmed that HHS was ending gain-of-function research and developing clearer oversight frameworks for such experiments. He also stated that NIH would cut funding for studies based on "radical gender ideologies" and instead prioritize what he described as essential or high-impact medical research.

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