Spotlight on Scientific Discovery & Engineering: Physics, Function & Future Frontiers

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This Spotlight series traces how physics-driven methods and engineering choices are reshaping what we can detect, build, and understand in living systems and how innovation is steered by society. Ultraweak photon emission imaging suggests a label-free window into vitality and stress responses across animals and plants. Ultrasound-enabled in vivo 3D printing extends fabrication beyond the limits of light, pointing toward on-demand implants formed beneath centimeter-thick tissues. In parallel, ribosome profiling and new screening strategies are revealing thousands of overlooked microproteins, expanding the functional map of genomes and opening fresh therapeutic and vaccine targets. An editorial on engineering impact underscores that lasting advances depend on clear problem framing, measurable improvement, and

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Abstract

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1. Imaging Ultraweak Photon Emission from Living and Dead Mice and from Plants under Stress

By Salari *et al*

This study explores biological ultraweak photon emission (UPE)—the spontaneous emission of extremely low levels of visible and near-visible light by living organisms, using highly sensitive EMCCD and CCD camera systems capable of detecting single photons to reliably measure UPE under physiologically relevant conditions. The experiments reveal clear differences in photon emission between live and dead mice, suggesting UPE correlates with biological vitality, while in plants, UPE intensity increased in response to stressors such as heat and physical injury and was further modulated by chemical treatments, with the application of the local anesthetic benzocaine to injured tissue producing the strongest emission signal. Overall, the findings highlight UPE imaging as a promising non-invasive, label-free approach for monitoring organismal vitality and stress responses across biological systems.

This article was previously published in *The Journal of Physical Chemistry Letters* on April 24, 2025.

Read the full article here

2. Replicating a tissue with sound waves

By Xiao Kuang

This perspective article spotlights ultrasound-enabled in vivo 3D printing as a route to fabricate tissue-like structures beneath centimeter-thick tissues, sidestepping the penetration limits of light-based printing. It highlights work by Davoodi *et al.* in which focused ultrasound triggers localized cross-linking of injected biocompatible sono-inks (prepolymer solutions containing temperature-sensitive liposomes that release cross-linkers upon heating), enabling rapid, high-resolution solidification in live mice and rabbits. Potential extensions include conductive hydrogels for bioelectronic sensing, drug-releasing patches, and cell-compatible patterning, while key translation challenges remain tissue heterogeneity, organ motion, materials tuning, and adaptive, image-guided process control.

This article was previously published in *Science* on May 8, 2025.

Read the full article here

3. Shining a light on the world of tiny proteins

By Carl Zimmer

Recent advances in genomics and ribosome profiling are revealing a vast, previously hidden layer of biology: microproteins, tiny proteins often shorter than 100 amino acids that were overlooked by traditional gene-finding methods. Reporting on multiple recent studies, this New York Times feature describes how thousands of such microproteins have now been identified across viruses, bacteria, plants, animals, and humans. Many originate from unconventional genes lacking classic start signals, explaining why they evaded detection for decades. New experimental approaches, especially scalable methods to probe viral genomes safely, suggest that microproteins play meaningful roles in infection, cell growth, and signaling, and may represent promising new targets for vaccines and therapies. Together, these findings point to a far more complex protein landscape than previously recognized.

This article was previously published in the *New York Times* on June 12, 2025.

Read the full article here

4. What makes a great engineering paper? Editorial insights into impact

By Communications Engineering Editorial Team

High-quality engineering research emphasizes practical solutions grounded in solid scientific evidence and reproducibility. Effective papers clearly define the problem being addressed, present creative and realistic innovations, and demonstrate measurable improvements over existing approaches through strong experimental validation. Clarity and transparency are essential—methodological details, data, and code should be openly shared so that others can replicate and build upon the work. Strong engineering studies also communicate their impact within a broader context, acknowledging both the limitations and potential applications of the findings. Well-structured visuals, concise writing, and clear explanations make complex information accessible, increasing the paper's influence and relevance across disciplines.

This article was previously published in *Nature* on May 27, 2025.

Read the full article here

5. Electric Vehicles Died a Century Ago. Could That Happen Again?

By Ivan Penn

The political obstacles to suppressing the advance of electric cars are not a problem that has arisen in our modern era. In fact, the first electric cars appeared in 1909, meaning that this innovation is not unique to the 21st century. Still, the threat they pose to oil companies, and therefore to financial and political agreements, has been dragging on for more than nine decades. This article dusts off history and reveals how certain policies, such as high purchase taxes, repeatedly delay attempts to achieve a more sustainable lifestyle, while concealing any progress from the public record.

This article was previously published in *The New York Times* on May 26, 2025.

Read the full article here

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