## Nanoscale Horizons



## **EDITORIAL**

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## Celebrating 120 years of excellence: National University of Singapore (NUS)

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This themed collection in the nanoscale family of journals (*Nanoscale Horizons*, *Nanoscale* and *Nanoscale Advances*) commemorates the 120th anniversary of the National University of Singapore (NUS). Founded in 1905 as a medical school, NUS has evolved into a world-leading university with a strong global presence. Over the past century, it has expanded far beyond its medical origins to become a comprehensive, research-intensive institution. Today, NUS is internationally recognized for its excellence in research, education, and innovation. Among its key strengths, nanoscience and nanotechnology stand out as a key area where the university continues to advance the frontiers of discovery, technological innovation, and real-world application.

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The portfolio of papers assembled in this collection illustrates the breadth, depth and vitality of nanoscale research by NUS

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A central theme is the development of nanomaterials for energy and environmental applications, an area of global urgency as societies seek clean and sustainable solutions. Nanostructures can offer unique catalytic activity, enhanced light absorption, and tailored electronic properties that make them highly effective in driving energy conversion. Tang et al. show how semi-oxidized TiC and TiCN phases enhance photocatalysis under visible light (Nanoscale Adv.,



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particular emphasis on energy transfer processes in lanthanidedoped nanomaterials, optical nanomaterials for neuromodulation and light-field imaging, advanced scintillators for X-ray imaging, and the design of electronic tools for assistive technologies.

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**Editorial** Nanoscale Horizons

https://doi.org/10.1039/D5NA00227C), while Xu et al. demonstrate Cu2S hierarchical nanostructures as efficient selfsupported photoelectrodes for photosupercapacitors (Nanoscale Adv., https:// doi.org/10.1039/D5NA00327J). Extending this theme, Zhu et al. review bioactive metal sulfide nanomaterials as photo-enhanced nanoreactors for tumor therapy (Nanoscale Horiz., https://doi.org/ 10.1039/D5NH00122F), illustrating how energy nanomaterials can also inspire biomedical innovation.

Healthcare challenges likewise drive rapid advances at the interface between nanomaterials and biology, where the ability to control nanoscale interactions with cells, tissues, and pathogens is enabling breakthroughs in diagnostics

and therapy. Chen et al. develop a graphene oxide/DNA aerogel sensor with approaches for gene therapy in hearing loss (Nanoscale Horiz., https://doi.org/10.1039/ D5NH00520E). Additionally, rapid and

high pressure and acoustic sensitivity, offering potential for wearable health monitoring (Nanoscale Horiz., https:// doi.org/10.1039/D5NH00117J). Zhu et al. report antimicrobial peptide-conjugated graphene coatings that show potent antibacterial and anti-biofilm properties (Nanoscale, https://doi.org/10.1039/ D5NR01674F). Broader perspectives expand this biomedical focus: Qi and Tay outline phage-nanomaterial platforms for antimicrobial therapy (Nanoscale, https:// doi.org/10.1039/D5NR02249E), and Liu et al. survey nanotechnology-enabled



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sensitive detection of viruses and other pathogens is crucial for public health, as reviewed by Sarza et al., who highlight nanoparticle-based biosensors deployed from "farm to fork" across the food chain (Nanoscale, https://doi.org/ 10.1039/D5NR01459J). Collectively, these works demonstrate how nanoscale strategies are redefining approaches to human health.

Equally important is the exploration of electronic and quantum materials, synthesizing materials with atomic and nanoscale precision, and controlling defects, interfaces, and lowdimensional properties are key to device innovation. Lyu et al. present a synthesis planning framework for atomically precise metal nanoclusters, showing how data-driven approaches can accelerate discovery in functional nanomaterials (Nanoscale Horiz., https://doi.org/10. 1039/D5NH00353A). Yang et al. provide atomic-level insights into defects in polycrystalline silicon-diamond structures, illuminating processes crucial to electronic materials engineering (Nanoscale Adv., https://doi.org/10.1039/D5NA00262A). Wen et al. measure the thermal conductivity of organic semiconductor nanoribbons, deepening our understanding of heat transport at the nanoscale (Nanoscale, https://doi.org/ 10.1039/D5NR02286J). Zhou et al. explore hydrogen-mediated reversibility of metallic states in MoS2 grain boundaries, suggesting pathways for tunable electronic properties (Nanoscale, https://doi.org/



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Bin Liu

Bin Liu is currently Tan Chin Tuan Professor of the National University of Singapore (NUS). She received her B.S. degree from the Nanjing University and PhD from NUS, before her postdoctoral training at the University of California, Santa Barbara. She joined NUS in late 2005 and was promoted to professor in 2016. Liu's research is focused on the development and innovation of organic nanomaterials for energy and

biomedical applications. She is among the World's Most Influential Minds and Top 1% Highly Cited Researchers in Materials Science and Chemistry 2014-2024.

10.1039/D5NR02232K). Beyond primary research, Huang *et al.* review two-dimensional ferroelectric synaptic devices for neuromorphic computing (*Nanoscale*, https://doi.org/10.1039/D5NR02639C), and Xiao *et al.* examine piezoelectric and ferroelectric effects in MEMS/NEMS platforms (*Nanoscale Horiz.*, https://doi.org/10.1039/D5NH00386E), reflecting the momentum of nanoscale electronics toward next-generation information technologies.

Finally, soft matter and multifunctional nanostructures illustrate how nanoscale science is expanding into flexible, adaptive, and bio-inspired materials. These systems are vital for emerging applications in wearables, robotics, and responsive electronics. Wang et al. review progress in stretchable soft antennas that integrate seamlessly with flexible (Nanoscale Horiz., doi.org/10.1039/D5NH00383K), while Le et al. highlight the biomedical potential of laser-induced graphene (Nanoscale Horiz... https://doi.org/10.1039/D5NH00377F). Zhang et al. show how chalcogen bonding regulates surface nanostructures, opening new avenues in supramolecular nanoscience (Nanoscale Horiz., https://doi.org/10.1039/ D5NH00463B). These examples demonstrate how soft materials are extending nanoscale innovation into new realms of function.

Taken together, the contributions in this collection underscore the diverse and interdisciplinary excellence of NUS in nanoscale research. From clean energy and environmental sustainability to advanced healthcare solutions, to the future of quantum and flexible electronics, these works reflect the vibrant ecosystem of innovation that NUS has cultivated over its 120-year history. As the university looks ahead, its leadership in nanoscience and nanotechnology will continue to inspire discoveries and applications that shape the global scientific and technological landscape in many more good years ahead.