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.

The portfolio of papers assembled in this collection illustrates the breadth, depth and vitality of nanoscale research by NUS affiliated researchers, ranging from energy and sustainability to nanomedicine, biosensing, quantum and electronic materials to soft matter systems. These contributions do not merely represent incremental advances but highlight how nanoscale science, through careful structural design and cross-disciplinary collaboration within and beyond NUS, continues to address some of the most pressing global challenges of our time.

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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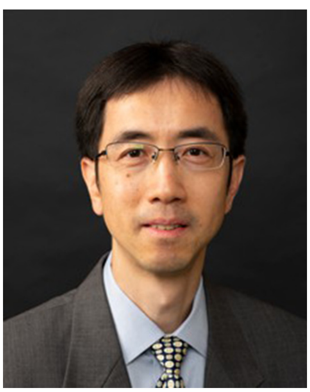

Zhiqun Lin

Zhiqun Lin is a professor in the Department of Chemical and Biomolecular Engineering at the National University of Singapore. His research interests include electrocatalysis, photocatalysis, solar energy conversion, batteries, multifunctional nanocrystals, conjugated polymers, block copolymers, hierarchical structure formation and assembly, and surface and interfacial properties.

Xiaogang Liu

Xiaogang Liu is a professor of chemistry at the National University of Singapore (NUS). He obtained his PhD from Northwestern University, USA, in 2004, and subsequently carried out postdoctoral research in the Department of Materials Science and Engineering at MIT. He joined the faculty at NUS in 2006 and was promoted to full professor in 2017. His research spans several areas of materials chemistry and nanoscience, with particular emphasis on energy transfer processes in lanthanide-doped nanomaterials, optical nanomaterials for neuromodulation and light-field imaging, advanced scintillators for X-ray imaging, and the design of electronic tools for assistive technologies.

https://doi.org/10.1039/D5NA00227C), while Xu *et al.* demonstrate Cu_2S hierarchical nanostructures as efficient self-supported photoelectrodes for photo-supercapacitors (*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 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 approaches for gene therapy in hearing loss (*Nanoscale Horiz.*, https://doi.org/10.1039/D5NH00520E). Additionally, rapid and 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, where synthesizing materials with atomic and nanoscale precision, and controlling defects, interfaces, and low-dimensional 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 MoS_2 grain boundaries, suggesting pathways for tunable electronic properties (*Nanoscale*, https://doi.org/

Ghim Wei Ho

Ghim Wei Ho leads the Sustainable Smart Systems research group at the National University of Singapore, where her work integrates nanomaterials, functional systems, and interfacial engineering for sustainable energy, environmental, electronics, and healthcare. She has published over 200 refereed papers and was recognised as a Clarivate Highly Cited Researcher in 2023 and 2024. An elected Scholar of Selwyn College, Cambridge, she has been a Cambridge Commonwealth Society Fellow, and is a Fellow of the Royal Society of Chemistry and recipient of the L'Oréal-UNESCO Fellowship. She serves on editorial boards including Journal of Materials Chemistry A, Materials Advances, and EcoEnergy.

David Tai Leong

David Tai Leong is an associate professor at the Department of Chemical and Biomolecular Engineering, National University of Singapore (NUS). He obtained his PhD in biology and Bachelor in chemical engineering from NUS and received his post-doctoral training at the Howard Hughes Medical Institute at the University of Pennsylvania. His research interests span the fundamental understanding of biological effects of nanomaterials to their applications in nanomedicine, biosensing and nanotoxicology.

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 devices (*Nanoscale Horiz.*, https://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.