ENGINEERING Health & Rehabilitation Engineering
https://doi.org/10.2738/ENGHRE.2026.0004

Editorial

Engineering the Future of Human Function: A Vision for Health and Rehabilitation

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1 Introduction: The Global Demographic Imperative

Today, an estimated one in three people globally requires rehabilitation services at some point in their lives. This staggering figure continues to rapidly climb in tandem with aging populations and the escalating global burden of chronic and non-communicable diseases [1,2]. The conditions necessitating rehabilitation are remarkably diverse: among others, they include systemic/neurological conditions (i.e., heart disease, stroke), mental health disorders, age-related functional decline, post-surgical recovery, and disabilities due to trauma or congenital factors. The breadth and scale of global need for rehabilitation services have far outstripped existing healthcare capacity to deliver adequate care.

This crisis is further exacerbated by severe, systemic workforce shortages. In both developing and developed nations, the ratio of rehabilitation professionals to patients is highly disproportionate. In heavily populated or lower income regions, this ratio can be lower than 1 rehabilitation worker per 100,000 people [3]. It has become unequivocally clear that the traditional human-labor-intensive model of healthcare cannot scale to meet this surging demand. To democratize access to functional recovery and care, we must move beyond conventional clinical models. Scalable advanced engineering solutions—including intelligent automation, therapeutic robotics, remote monitoring, and closed-loop systems—represent a promising sustainable path forward, offering ways to augment existing workforce capacity and deliver more accessible and efficient care [4–7].

2 A Dual Mandate: Defining "Health" and "Rehabilitation" Engineering

Against the backdrop of this global rehabilitation challenge, publishing new knowledge in health and rehabilitation engineering is critical to advancing the translational impact of engineering innovations. The Chinese Academy of Engineering (CAE), in partnership with the University of Health and Rehabilitation Sciences (UHRS), is proud to launch *ENGINEERING Health & Rehabilitation Engineering*. As a new pillar within the CAE's elite *ENGINEERING* journal cluster, this publication operates under a dual mandate encoded in its title, distinguishing it from general biomedical or public health engineering journals.

Health Engineering represents the proactive application of engineering principles and technologies to maintain human function and prevent physical or cognitive decline, which spans disease prevention, diagnosis, treatment and management. Rehabilitation Engineering represents the restorative application of engineering principles and technologies to recover and augment lost human function following injury, disability, or disease [8].

We emphasize that while clinical medicine and allied health professions, such as physical and occupational therapy, stand as the ultimate beneficiaries and collaborative endpoints of our work, rigorous engineering will be a key engine driving this progress. The journal's scope is distinctly centered on advanced technologies and processes that benefit fields such as artificial intelligence, biomedical signal processing, biomechanics, motor

Received 12 May 2026; accepted 22 May 2026

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control, neural-machine interfaces, neuromodulation, prosthetics and orthotics, robotics, virtual reality, mobility aids and others.

3 The Evolution of the Field: From Neuro to Systemic Health Ecosystems

To chart our future, we must respectfully acknowledge the historical foundations of our discipline. Rehabilitation has long been a borderless endeavor, driven by the need to restore human agency. Early rehabilitation engineering was largely focused on the physical restoration of the body alongside the tools to help clinicians meet these needs [9]. At the turn of the millennium, the advent of computer technology unlocked the ability to analyze the electrical signals of our nervous system at an unprecedented scale, allowing for a greater understanding of many of the dominant causes of physical disability. This transformation is exemplified by the expansion in scope of *IEEE Transactions on Rehabilitation Engineering* (TRE) to become *IEEE Transactions on Neural Systems and Rehabilitation Engineering* (TNSRE) in 2000 [10]. Shortly thereafter, the launch of *Journal of NeuroEngineering and Rehabilitation* (JNER) in 2004 further catalyzed the last two decades of explosive growth in neural engineering, fostering research into electrophysiology, functional electrical stimulation (FES), and brain-computer interfaces (BCIs) [11].

The launch of *ENGINEERING Health & Rehabilitation Engineering* does not represent a departure from these incredible neuro-technological roots; rather, it is their necessary evolution. For decades, highly engineered neuro-technologies have often remained confined to isolated laboratory environments or tightly controlled clinical trials [12]. Our mission is to pull these advanced technologies out of isolation and integrate them into a broader, systemic, and highly translatable "health and rehabilitation" ecosystem. We seek to publish research that bridges the gap between proof-of-concept emerging technologies and robust real-world applications that interact with people and environments in daily life.

4 Personifying the Mission and Institutional Synergy

The journal's leadership embodies the interdisciplinary integration of systemic health and advanced engineering. As Editor-in-Chief, Academician Erdan Dong provides overarching strategic leadership, guiding the journal's overall academic orientation and development. Supported by his profound expertise in medical science, health strategy and policy, he ensures all engineering innovations address critical clinical and societal health demands, anchoring the journal's core academic mission and value. As Co-Editor-in-Chief, Professor Ping Zhou contributes specialized strengths in engineering research and clinical translation. With rigorous academic training and research experience at world-renowned rehabilitation institutions, including the Shirley Ryan AbilityLab (the former Rehabilitation Institute of Chicago) and TIRR Memorial Hermann, he underpins the journal's technological excellence and global innovation capacity.

As the journal's institutional host, UHRS serves as a key interdisciplinary hub. Leveraging its robust academic ecosystem, we advance industry-academia-clinical collaboration and accelerate the translation of theoretical discoveries into practical clinical outcomes.

5 A Global Call to Action: Bridging Two Worlds

As a member of the CAE's flagship *ENGINEERING* portfolio, *ENGINEERING Health & Rehabilitation Engineering* is designed to bridge two distinct but complementary worlds.

To the elite engineering community within the CAE ecosystem and beyond—those pioneering next-generation materials, artificial intelligence, and mechatronics—we invite you to point your innovations toward human health and functional restoration.

To the global health and rehabilitation engineering community, we offer an invitation to leverage the CAE's massive translational ecosystem, robust resources, and borderless platform to scale your innovations globally.

The modernization of healthcare systems to advance human well-being is not a regional challenge, but a global one. By bridging rigorous engineering innovation with rehabilitation science and clinical medicine, we can redefine the limits of human recovery. We invite researchers, engineers, and clinicians worldwide to join us in engineering the future of human function.

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