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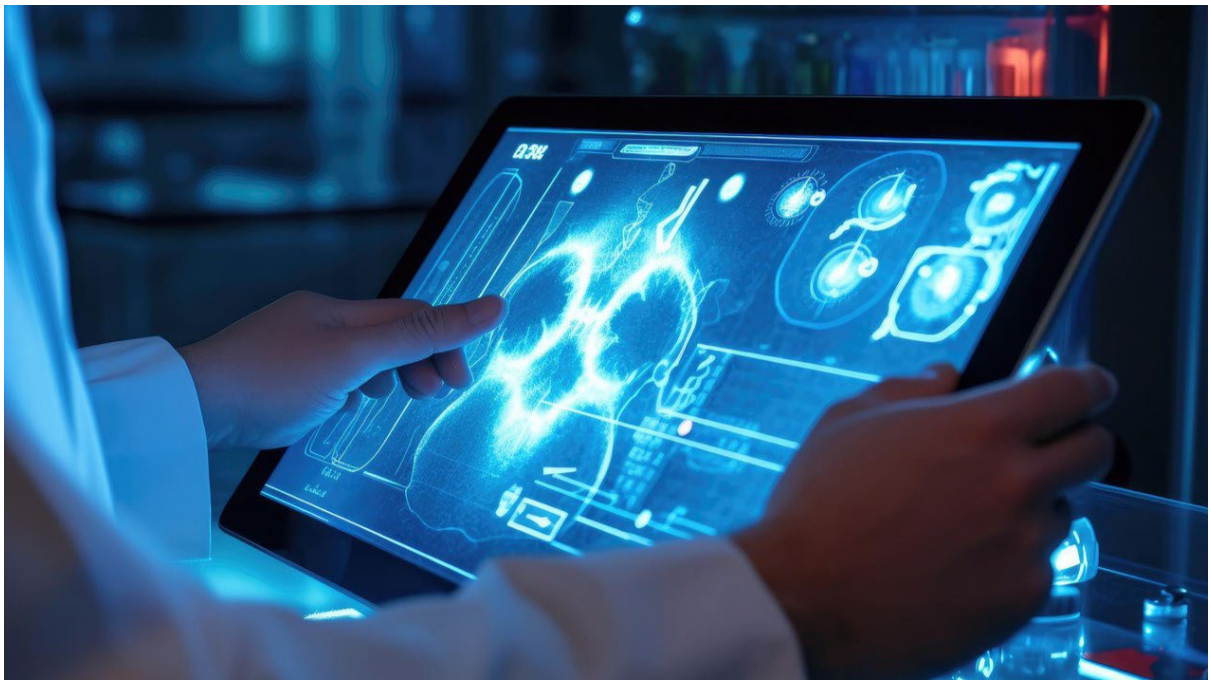
Nature-Inspired Drug Delivery: Revolutionising Medicine at NTU



Self-assembly, a phenomenon prevalent in diverse biological systems, has long intrigued scientists due to its immense potential for innovation and application. At Nanyang Technological University, Singapore (NTU Singapore), a team of researchers, led by Assoc Prof Yu Jing and comprising Dr Li Haopeng and Dr Qian Xuliang, has embarked on a groundbreaking endeavour.

They have harnessed inspiration from the self-assembling proteins inherent in the cuticles of Asian corn borer moth caterpillars to engineer a transformative drug delivery system. This pioneering initiative not only promises to revolutionise the landscape of drug delivery but also underscores the profound impact of biomimicry in advancing scientific and technological frontiers.

The implications of this discovery are profound and multifaceted. Unlike conventional delivery methods fraught with toxicity and inefficiency, these nanocapsules embody a paradigm shift, heralding a new era of precision medicine. With the ability to accommodate an array of drugs and therapeutic agents, from chemotherapy drugs to antibodies and mRNA, these capsules represent a versatile platform for targeted delivery to cells, circumventing the barriers of toxicity and off-target effects.

Dr Li Haopeng underscores the significance of this breakthrough, emphasising its potential to revolutionise drug delivery and personalised medicine. Dr Qian Xuliang echoes this sentiment,

highlighting the convergence of biology, materials science, and engineering in translating nature's self-assembly principles into tangible solutions with far-reaching implications for human health.

The Asian corn borer moth, notorious for its deleterious impact on corn crops, harbours proteins within its cuticle that exhibit remarkable self-assembling capabilities. Through meticulous analysis, the researchers identified peptides capable of autonomous assembly into ordered structures, laying the foundation for constructing hollow nanocapsules – a pivotal breakthrough in the realm of drug delivery.

The process of self-assembly, akin to orchestrating molecular Lego blocks, unfolds seamlessly as peptides are dissolved in water and subjected to specific conditions. By introducing acetone, a cascade of events is initiated, culminating in the rapid formation of spherical nanocapsules within minutes. This dynamic process, driven by concentration gradients, offers precise control over capsule size – a feat achieved through the judicious adjustment of peptide ratios.

Looking ahead, the researchers envision leveraging artificial intelligence to expedite the discovery of novel self-assembling peptides, thereby expanding the repertoire of customisable drug delivery systems. This fusion of cutting-edge technology with biomimetic design principles epitomises the interdisciplinary nature of scientific inquiry, catalysing breakthroughs with profound societal impact.

The journey from caterpillars to capsules exemplifies humanity's enduring quest to unravel nature's mysteries and harness its inherent ingenuity for societal benefit. As scientists delve deeper into the intricacies of self-assembly, we embark on a transformative odyssey, where innovation converges with inspiration, shaping the future of drug delivery and beyond. In the crucible of scientific inquiry, nature stands as the ultimate architect, offering a blueprint for progress and possibility.

NTU stands at the cutting edge of innovation, continually pushing the boundaries of knowledge and technology to foster groundbreaking discoveries and transformative solutions. It spans diverse disciplines like sustainable energy, biomedical engineering, digital transformation, and AI, shaping the future of science, tech, and society.

OpenGov Asia reported that NTU scientists have developed a smart adhesive inspired by the remarkable grip of gecko feet. Led by Professor K Jimmy Hsia, the team utilised shape-memory polymers to create an adhesive with over ten times the strength of gecko feet. This innovation promises versatile applications, from superglue to heavy-load grippers, marking a significant advancement in adhesive technology.

In another development, a wearable skin sensor, born from a decade-long collaboration between MIT researchers and the Singapore-MIT Alliance for Research and Technology (SMART), is set to transform skincare. Crafted with cutting-edge materials and soft electronics, this sensor offers objective skin health measurements, guiding product development and customisation in skincare science.

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