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Dr Yifan Chen is a Distinguished Professor in the School of Life Science and Technology, University of Electronic Science and Technology of China. He received the B.Eng. (Hons. I) and Ph.D. degrees in electrical and electronic engineering from Nanyang Technological University, Singapore. He has held various academic and leadership positions in top-tier universities in China, New Zealand, UK, and Singapore across multiple disciplines such as electrical and electronic engineering, biomedical engineering, and computer science and engineering. He is a Fellow of Engineering New Zealand, a Fellow of The Institution of Engineering and Technology, UK, and a Fellow of European Alliance for Innovation. He is a Senior Editor/Associate Editor/Guest Editor for several cross-disciplinary journals such as IEEE Transactions on Nanobioscience, IEEE Transactions on Molecular, Biological, and Multi-Scale Communications, IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology, IEEE Open Journal of Antennas and Propagation, and IEEE Journal of Biomedical and Health Informatics. His current research interests include in vivo computation where computing meets bio-sensing, molecular and biological communications where communicating meets bio-transporting, and electromagnetic biomedicine where RF sensing meets bio-imaging. His research has received media coverage from IEEE Spectrum, IET, Engineering New Zealand, The New Zealand Herald, etc.

Title: Computational Nanobiosensing - Where AI Meets Nanorobotics for Smart Tumor Sensing

Abstract: We will present the emerging field of computational nanobiosensing (CONA), where agile searching strategies to manipulate swarms of externally controllable or autonomous nanorobots are proposed to improve the success rate of tumor sensing by orders of magnitude. In the case of externally manipulable nanorobots, an external system can be used to probe the tumor microenvironment by analyzing the observable characteristics of these nanorobots, such as their trajectories and vitality during their interaction with tumor-induced biological gradients such as temperature, pH, and enzymatic activity; the biological gradient field (BGF) can be utilized by the

external system to guide the steering of nanorobots towards the prospective target location via the shortest possible physiological routes and with minimum systemic exposure. On the other hand, in the case of autonomous nanorobots, the BGF can stimulate nanorobots to undergo morphological changes. Such deformation of nanorobots, along with their socializing ability, could be used to achieve autonomous tumor homing, where millions of nanorobots move collectively and search for a tumor autonomously. The CONA framework has a great potential in improving the performance of early tumor diagnosis and targeted drug delivery, which may potentially revolutionize the existing nanomedicines practice.