

Pankind 2026 Scientific Meeting

Poster Abstract Form

Title: Nanomotors for the early detection of Pancreatic Ductal Adenocarcinoma

Srikrishnan Ramachandran, Motilal Mathesh Shanmugam, Shawn Goussous, Wenrong Yang

1. School of Life and Environmental Sciences, Deakin University, 75 Pigdons Road, Waurin Ponds- 3216, Australia

2. Nanocube Health, Melbourne VIC 3000, Australia

Autonomous micro- and nanoscale systems are emerging as powerful tools for next-generation biomedical technologies, offering bioinspired strategies for navigating and interrogating complex disease environments^[1-3]. Nanostructures can provide an ideal scaffold for nanomotor design^[4] and enhanced biomolecular interactions relevant to pancreatic ductal adenocarcinoma (PDAC).

In this study, we develop nanomotors using an enzyme-based nano-architectonics approach, employing both covalent and non-covalent architectures to evaluate their impact on propulsion and chemotactic behaviour under PDAC-relevant biochemical conditions. We demonstrate that nanomotors can show propulsive movement in an environment similar to tumor microenvironmental conditions of PDAC. Additionally, we show that the magnitude of nanomotor propulsion can be precisely tuned through microenvironmental parameters reflective of the PDAC tumour milieu.

The ability to direct nanomotor motion and regulate chemotactic behaviour underscores their potential as active nano-sensing elements for early PDAC detection. These findings position nanomotors as promising candidates for future cell-mimetic diagnostics, targeted delivery, and integration into multifunctional biosensing platforms aimed at shifting PDAC diagnosis toward earlier, more treatable stages.

References:

- [1] H. Ma, R.-F. Li, Z.-L. Yu, "Micro/nanomotors in targeted drug delivery: Advances, challenges, and future directions," *International Journal of Pharmaceutics* 674 (2025): 125471 <https://doi.org/10.1016/j.ijpharm.2025.125471>
- [2] J. Wu, S. Balasubramanian, D. Kagan, K. M. Manesh, S. Campuzano, J. Wang, "Motion-based DNA detection using catalytic nanomotors," *Nature Communications* 1 (2010): 36 10.1038/ncomms1035
- [3] X. Wang, H. Ma, Y. Guo, J. Zhang, X. Han, "Mesoporous Organosilica-Platinum Janus nanomotor coordinated by charge reversal for deep tumor penetration and promoted chemotherapy," *Chemical Engineering Journal* 490 (2024): 151777 <https://doi.org/10.1016/j.cej.2024.151777>

[4] M. Mathesh, E. Bhattarai, W. Yang, "2D Active Nanobots Based on Soft Nanoarchitectonics Powered by an Ultralow Fuel Concentration," *Angewandte Chemie International Edition* 61 (2022): e202113801 <https://doi.org/10.1002/anie.202113801>