

Engineered cells that detect and kill a pathogen: A novel synthetic biology-based antimicrobial strategy

Nazanin Saeidi, Choon-Kit Wong, Tat-Ming Lo, Hung Xuan Nguyen, Mohamed Arshath, Susanna Leong Su Jan, Chueh Loo Poh and Matthew Wook Chang

Nanyang Technological University, Singapore

Synthetic biology has allowed us to design and construct new biological systems that have the potential to resolve important issues related to healthcare. Considering the stalled development of advanced antibiotics and the emergence of antibiotic-resistant pathogens, we now must strive to exploit synthetic biology approaches for designing a new treatment regimen for infectious diseases. Therefore, in this study, we aimed to engineer microbes to detect and kill a pathogen using synthetic biology principles. Briefly, we designed and constructed a genetic system, which comprises detecting and killing devices, that enables *Escherichia coli* to sense and kill a pathogenic *Pseudomonas aeruginosa* strain. We further characterized individual devices to understand their functionalities, which helped us to construct the final system and verify its behaviour. Finally, we showed that our engineered *E. coli* detects and kills *P. aeruginosa*, which offers a novel synthetic biology-based antimicrobial strategy that could readily be expanded to treating other infectious pathogens. For further optimization of our current system, we have also done mathematical modelling on the quorum sensing device using computer aided design (CAD) tools to capture steady state and dynamic behaviour of the system.

Biography

Nazanin Saeidi has completed her Ph.D. at the age of 27 years from School of Chemical and Biomedical Engineering at Nanyang Technological University, Singapore. She is currently doing her postdoctoral studies at Singapore Membrane Technology Centre. She has published few papers in reputed journals like Molecular Systems Biology from Nature publishing group and has presented her works in international conferences. She also has one published patent at United States Patent.

nazaninsaeidi@ntu.edu.sg

Long aligned carbon nanotubes and their proposed potential application

Pitamber Mahanandia

National Institute of Technology, India

Ultra long aligned carbon nanotubes (CNTs) have been synthesized by a simple technique. The parallel arrangement of the CNTs, as well as their tube diameter has been verified spectroscopically by small angle X-ray scattering (SAXS) studies and the diameter has been well supported by transmission electron microscopic (TEM) analysis. The electrical transport has been studied on the bundles of aligned CNTs. Controllable resistance of multi-walled carbon nanotube bundles could be used for the possible application in nanoscale electronics. It has been observed that the resistance as well as the variation of resistance with temperature depends on the bundle diameter. The larger the diameter smaller is the resistance and weaker is the variation of resistance with temperature that makes the bundles advantageous in nanoscale electronics and in some other applications. Similarly, as the resistance and the variation can be controlled by monitoring the bundle diameter, the temperature dependency of resistance can also be employed in temperature thermometry. The resistance increases with the decrease in temperature as in the case of carbon, carbon glass resistance thermometer, and carbon nanotubes reported in the literature. The rate of the variation of resistance depends on the resistance of the bundle at room temperature which can be explored for the low temperature thermometry. Overall, the resistance and the sensitivity of the bundle depend on the bundle diameter which can be monitored easily. The electrical transport study on polymer (PMMA) infiltrated aligned CNTs shows variable range hopping (VRH) transport mechanism mainly in the axial and field induced transport in the perpendicular direction.

Biography

Pitamber Mahanandia completed his Ph.D. in 2008 from the Department of Physics, Indian Institute of Science, Bangalore, India. Afterward, he spent few years in USA and Germany as postdoctoral researcher. He joined as an Assistant Professor in the Department of Physics, National Institute of Technology, Rourkela, Odisha, India. He has published about 15 papers in international journals and some are in pipeline to be published. His work is based on CNTs and graphene and respective polymer composites materials mainly to study the electrical and mechanical properties.

pitam@nitrrl.ac.in