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Editorial

Editorial for 'focus collection in memory of Prof Mark A Reed'

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This special collection issue is dedicated to Professor Mark Reed, who passed away on 5 May, 2021. Mark was a nano-technological daredevil, and realized some of the most challenging technological breakthroughs during his career. He not only worked a myriad of different topics in nanotechnology, including mesoscopic systems, molecular electronics, nanofluidics and bioelectronics, but also was able to make important contributions to each one. While at Texas Instruments in 1988, he realized for the first time zero-dimensional tunneling in a semiconductor heterostructure and termed it a 'quantum dot' [1], ushering in decades of research on semiconducting quantum dots, quantum computing, applications in semiconducting lasers. Indirectly his research led to the 2023 Nobel Prize in chemistry, where his contributions were cited in the press release. Mark was recruited to the Yale faculty in 1990 and in collaboration with James Tour's group at Rice university characterized conductance through a single molecule in 1997 [2] and then demonstrated a single molecular transistor [3]. This research also opened up the new field exploring electronic transport through single nano-objects. More recently his group explored bioelectronics systems and microfluidics. Most notable was the demonstration of label-free immunodetection using semiconducting nanowires and how microfluidic purification prior to sensing can allow for biomarker detection from whole blood [4].

Mark was not only a scientific visionary, but also an inspiration to all that knew him. He perennially showed a humility and kindness that remains with those with whom he worked. His optimism about what is possible inspired his research, students and colleagues to heights that would have not otherwise been possible. Mark placed great importance on mentoring young scientists. He graduated 23 PhD students and mentored 14 post-docs who he continued to support when asked, even many years after their thesis. At Yale he was the director of undergraduate studies where he mentored many young engineers and scientists find their future path. Mark was an active member of the IOP community as the Editor-In-chief of the journal Nanotechnology (2009–2019). He also founded the journal Nano Futures. For this reason, in 2022 IOP instituted the 2022 Mark Reed young researcher award.

This collection focuses on the pioneering work inspired by Mark Reed. The topics cover research areas that were of interest to Mark Reed during his career, including microfabricated quantum dots, nanostructures and nanowires, molecular electronics, biosensors, and nanofluidics. In particular, this collection features 3 topical reviews. A review focuses on how Schottky barrier source and drain transistors, the thesis topic of L Calvet who was a former member of Mark Reed's group, are used in emerging devices [5]. Another review written by three former members (J Chen, T Lee, and C Zhou) summarizes Mark Reed's seminal work in the field of molecular electronics [6]. Last one is on the use of polymer nano-carriers for treating brain tumors, written by the group of a Yale colleague, WM Saltzman [7]. And, this collection also contains 6 new research articles. P Burke, a collaborator with Mark Reed, contributed an article on nanowire biosensors that could function as an electronic nose with high sensitivity and selectivity [8],

M Weber, a former member, contributed a series of articles on the theoretical and experimental studies of dielectrophoretic capture and detection of microbial cells [9, 10], W Guan, a former member, wrote an article on modeling study of pyramidal silicon nanopores which can be an effective analytical tool for ion transport [11], Y Jung, also a former member, wrote an article on vertically aligned two-dimensional (2D) molybdenum disulfide (MoS_2) layers for gas sensors [12]. And, M S Strano, a collaborator with Mark Reed, contributed an article on 2D hexagonal boron nitride (hBN) for quantum emission [13].

As group members and long-term collaborators of Mark Reed, we hope that this collection of reviews and articles will be a memorial to all who know him. We are all very grateful for his support, mentorship and collaboration during student or postdoc periods or during professional careers. We have had the honor of working with him. We miss him dearly and he lives on in us.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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