Functional carbon nanoprobe in microRNA bioanalysis

Haifeng Dong

Laboratory for Bioengineering and Sensing Technology, Research Center for Bioengineering and Sensing Technology, School of Chemistry & Biological Engineering, University of Science & Technology Beijing, Beijing 100083, P.R. China

microRNAs (miRNAs) are a class of non-protein coding RNAs, which play significant regulated role in a diverse groups of animals, plants and viruses. There have been identified more than 1800 precursors and more than 2500 mature miRNA sequences for the human species, regulating more than two-thirds of genes that code functional proteins[1,2]. Therefore, miRNAs are promising biomarkers for diagnosis and prognosis of the onset of disease states, providing an attractive pathway in gene therapy for genetic disorders and potential drug targets. However, the detection of miRNA remains great changes due to the characteristics of miRNA including small size, low abundance and sequence similarity among family members.

The increasing demand of clinical biomedicine and fast development of nanobiotechnology has substantially promoted the generation of a variety of organic/inorganic nanosystems for biomedical applications [3,4]. The recent process of our group in carbon nanomaterials-based miRNA bioanalysis will be presented. By employing top-down or bottom-up methods, we fabricated a series of carbon-based nanomaterials or analogous, which were further modified to impart new properties to develop novel electrochemical and optical methods (Figure 1) for in vitro miRNA bioanalysis and design multi-functional nanoprobes for gene delivery (Figure 2), cell imaging, and intracellular miRNA detection.

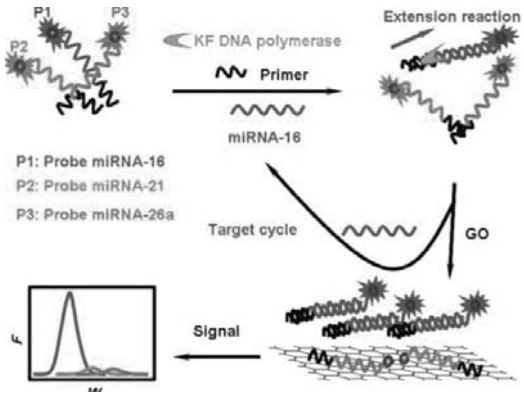

Fig.1: Graphene oxide-based fluorescence quench multiple miRNA detection

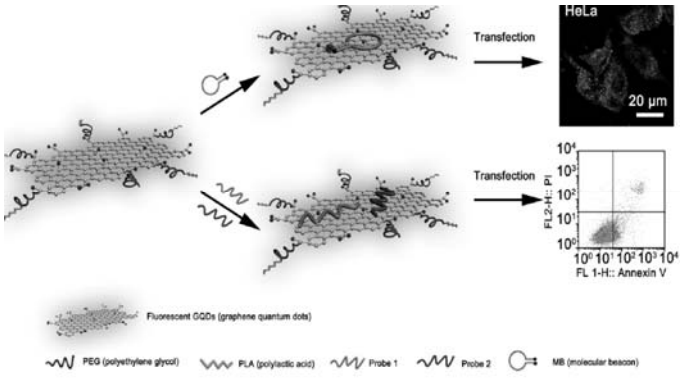

Fig.2 Graphene quantum dots for intracellular miRNA imaging and improved therapeutics

[1] H.F. Dong , X. J. Zhang *et al*. Chem. Rev. **113**, 6207(2013)
[2] H.F. Dong, H. X. Ju et al. Angew. Chem. Int. Ed. **51**, 4607(2012)
[3] H. F. Dong, X. J. Zhang et al Acs. Appl. Mater. Inter. **7(20)**, 11015(2015)
[4] H. F. Dong, X. J. Zhang et al Small DOI: 10.1002/smll.201500208. (2015)

Corresponding Author: Haifeng Dong
Tel/Fax: +86-10-82375840
E-mail: hfdong@ustb.edu.cn