Biomedical Research & Therapy

ISSN: 2198-4093
www.bmrat.org

PLENARY

Advanced Nanotechnologies for Cancer Research

Peilin Chen

Research Center for Applied Sciences, Academia Sinica, Taiwan

Abstract

In this lecture, I will discuss the recent developments in our group in the advanced optical imaging systems, nanocarriers and nanodevices for caner research. I will first discuss the development of various nanoparticles for sensing the pH value in cellular environment. By surface functionalization schemes, it is possible to control the location of nanoparticles in cells allowing us to track the local pH value around the nanoparticles inside cancer cells. As for in vivo study, we have utilized the multi-photon microscopy to investigate the disease models with the help of nanoparticles. I will discuss the enhanced permeability and retention (EPR) effect, which is a key feature of tumor blood vessels. In general, EPR-mediated passive targeting highly relies on the prolonged circulation time of nanocarriers. Particularly important two parameters, (1) nanocarrier size and (2) surface property are expected to play a key role on the pharmacokinetics and the biodistribution of the carrier material. Previously studies highlighted protein corona neutrality as an important design in the development of targeted nanomaterial delivery and demonstrated that a small difference in the surface heterogeneity could result in profoundly different interactions with cells and tissues. Therefore, the control and understanding of protein corona composition are critical for successful EPR-targeted nanomedicine. I will use mesoporous silica nanoparticles (MSN) nanoparticles as an example to illustrate the effect of size and the surface heterogeneity of MSN on their biological fate both in vitro and in vivo. I will also summarize our recent development of the circulating tumor cells (CTCs) isolation chips. CTCs are cancer cells that break away from a primary tumor or metastatic site, escape from immunosurveillance, and then circulate in the peripheral blood with the capability of forming distant metastases. The identification of CTCs in patient blood samples is technically challenging because of the extremely low concentration of CTCs among a large number of hematologic cells. To address this unmet need for rare cell isolation, we have developed substrates using the synergistic effect of nanomaterials and biological immobilization of CTC markers for enhancing CTC capture efficiency during a liquid biopsy procedure. In addition to the pursuit of high-cell-capture yield and specificity from human blood on chips, further vertical integration for the downstream characterization of CTCs is required for future CTC chips, such as liquid biopsy, for achieving a variety of clinical applications. In our approach, we have employed three-dimensional (3D) conducting polymer-based bioelectronic interfaces (BEIs) that can be integrated on electronic devices for rare circulating tumor cell (CTC) isolation, detection, and collection via an electrically triggered cell released from chips.

*For correspondence:

peilin@gates.inica.edu.tw

Competing interests: The authors declare that no competing interests exist.

Received: 2017-05-05
Accepted: 2017-05-29
Published: 2017-09-05

Biomedical
Research & Therapy

ISSN: 2198-4093
www.bmrat.org

Keywords

Funding

References

DOI 10.15419/bmrat.v4iS.216