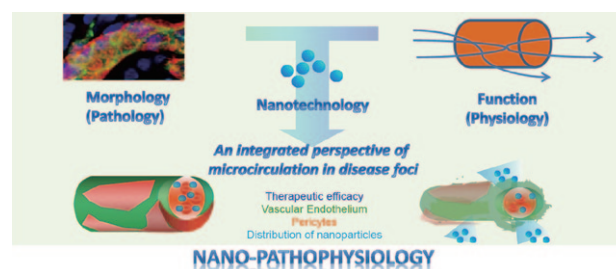


Research Highlights

Dawning of nano-pathophysiology

Nanotechnology, an emerging but still relatively new technology for biology, can provide fresh and exciting insights into the mechanism of disease, thinks Professor Mitsunobu Kano, at the Department of Pharmaceutical Biomedicine of Okayama University. He named this field of biology as "nano-pathophysiology", for the technology can visualize previously unproven relationships between morphological and functional aspects of disease, in combination with conventional methodologies.

Based on his achievements in vascular biology on applying nanomedicine in cancer, Prof. Kano here describes a powerful example of potential novel insights provided by applications of nanotechnology.



An example of "nano-pathophysiology". Nanotechnology can for example integrate morphological and functional aspects in therapeutic vascular biology for disease.

The advantage of medicine of the nano scale, or nano drug delivery systems (nanoDDS), is to reduce toxicity of the "cargo" and maximize efficacy. The theoretical basis of this advantage is increased vascular permeability of disease tissue, especially in cancer, to healthy one. The effect was named as "enhanced permeability and retention (EPR) effect", by Japanese researchers in 1980s. However, biological aspects and diversity of this effect between various diseases have not been elucidated thoroughly. Also, we do not have experimental models optimized for studying this aspect: various mechanisms affecting the delivery of nanomedicine following the pathway in the body. Two-dimensional cell lines culture or animal models containing just tumor cells and leaky vessels are obviously not appropriate for this purpose. Prof. Kano therefore highlighted the need of disease models, which are clinically more relevant from the view point of "nano-pathophysiology": the models reflecting the paths for the nanoparticles to get to the target tumor cells.

In biology and medicine, novel technologies have always greatly advanced our understanding of the mechanisms of disease. Cytopathology, a major field in medicine for example, were established only after introduction of the achromatic microscope and application of chemical dyes and fixatives in the early 19th century, which allowed advances to be made in visualizing morphology and function at a microscopic level. It is therefore appropriate thinks Prof. Kano, to recall these basic advances in biomedical technology, and their provision of fresh and exciting insights into the pathophysiology of disease.

This is an article in a coming theme issue for *Advanced Drug Delivery Reviews* on "nanopathophysiology", which Prof. Kano is guest-editing based on the point of view described above. In this review, Prof. Kano emphasizes how use of nanoparticles can open up new perspectives in analyzing the therapeutic and functional influences of microcirculation in tumors, which can further determine the refractoriness of the disease.

Reference:

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