Friday, April 5, 2024 – 11.30 a.m.

Department of Materials Science U5 - Seminar room – 1 st floor

Nanoparticle-Based Medical Nanodevices for Cancer Nanomedicine

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Abstract

Nanomedicine is promising to improve conventional cancer medicine by making diagnosis and therapy more accurate and more effective in a more personalized manner. A key of the cancer nanomedicine is construction of medical nanodevices by programming most of the following functions to nanoparticles (NPs); A) high dispersibility in a physiological environment, B) high stealth efficiency to slip through the trap by liver and spleen, C) high targeting efficiency to cancer tissue, D) clear visualization of cancer for diagnosis, and E) high anticancer activity for treatment (Figure 1a) [1].

In our approach, poly(glycerol) (PG), containing a hydroxy group at every monomer unit, was found as a better alternative to poly(ethylene glycol) (PEG), the most commonly used hydrophilic polymer, giving A) high dispersibility to inorganic NPs [2]. Although most of the inorganic NPs are not dense in functional groups, the hyperbranched structure with many hydroxy groups in PG turns the less functional surface into highly functional one, imparting not only good hydrophilicity, but also B) high stealth efficiency we reported recently [3]. In addition, a number of hydroxy groups in PG afford the structural or functional extensibility to introduce the additional layer or function. This enables us to design and construct a three-layer architecture consisting of core inorganic NP, hydrophilic and stealthy PG layer, and functional molecule layer (Figure 1b). Owing to the versatility of the three-layer model, the rest of the above functions C) – E) can be programed to the NP core and/or the outmost layer in nanodevices [4-7].

In an invited talk, I will present functional programming of inorganic NPs and their application to cancer nanomedicine [1].

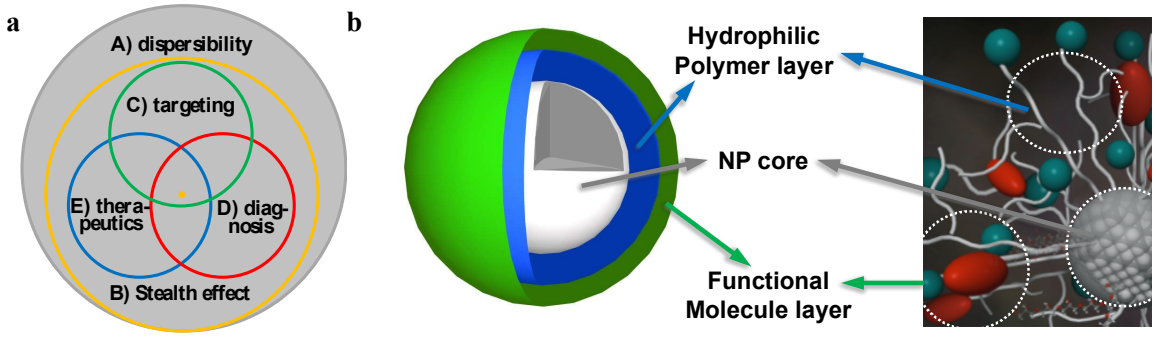

Figure 1. (a) Schematic illustrations of three-layer construction in and (b) requisite functions for a biomedical nanodevice.

References

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[3] Y. Zou, S. Ito, F. Yoshino, Y. Suzuki, L. Zhao, N. Komatsu,* *ACS Nano*, 1**4**, 7216 (2020).

[4] F. Yoshino, T. Amano, Y. Zou, J. Xu, F. Kimura, Y. Furusho, T. Chano, T. Murakami, L. Zhao,* N. Komatsu,* *Small*, **15**, 1901930 (2019) [highlighted at the back cover].

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[7] Y. Zhang, H. G. Kang, H. Xu, H. Luo, M. Suzuki, Q. Lan,* X. Chen,* N. Komatsu,* L. Zhao* *Adv. Mater.*, **35**, 2301479.

Biography

Naoki Komatsu received his bachelor's, master's and doctor's degrees from Kyoto University in 1986, 1988 and 1993, respectively. He joined Okayama University in 1993 and moved to Kyoto University as Assistant Professor in 1994. In 1997, he worked at Florida State University as a visiting scholar for one year. In 2003, he moved from Kyoto University to Shiga University of Medical Science as Associate Professor. He was promoted to Professor at Kyoto University in 2015. His research concept is to "apply organic chemistry to nanomaterials" including supramolecular chemistry for structural separation of nanocarbons and synthetic organic chemistry on inorganic nanoparticles for cancer nanomedicine.