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Colorimetric screening of DNA-functionalized gold nanoparticles with drug-nucleic acid interactions

Gold nanoparticles modified with high surface-density of DNA (DNA–AuNPs) have been widely used in highly sensitive bioassays. Until now, we developed a colorimetric single-nucleotide polymorphism (SNP) genotyping method and detected dynamic structural changes in DNA-AuNP assemblies with beads on string-like structure based on a unique phenomenon of non-crosslinking aggregation of double-stranded DNA-functionalized AuNPs (dsDNA–AuNPs). For example, dsDNA–AuNP having a full-match sequence can undergo aggregation in highly ionic aqueous solutions, showing a drastic color change owing to a band shift of the surface plasmon resonance. On the contrary, dsDNA–AuNP having a mismatch sequence can remain dispersed under the same conditions. Recently, we have also demonstrated the extremely higher colloidal stability of ds DNA–AuNP having a single-base protrusion as compared with that of dsDNA–AuNP having a mismatch sequence. This behavior allowed us to perform more reliable SNP genotyping of the human related-cytochrome P450 2C19 gene that plays a role in the metabolism of pharmaceutical agents. Notably, drastic color change can be induced by single-base differences in the dsDNA located on outermost surfaces of AuNP in highly ionic aqueous solutions. In this study, we attempted to assess colorimetric drug efficacy of small molecules to facilitate selection of DNA-associated drugs that have a mechanism related to an antitumor activity. The rapid color difference derived from high colloidal stability can allow visual screening of potent antitumor agents.

Biography

Yoshitsugu Akiyama has completed his PhD at the age of 28 years from University of Tokyo. He started postdoctoral studies from University of Virginia and The Biodesign Institute at Arizona State University in US (2004–2009) and was promoted to Research Assistant Professor with Prof. Sidney M. Hecht in 2009. Then he joined NOF Corporation, followed by RIKEN as a Senior Research Scientist in Japan (2010–2015). He is now an Assistant Professor in the Faculty of Industrial Science and Technology at Tokyo Universtiy of Science. He has been serving as an editorial board member of *Journal of Drug Toxicology and Pharmacology*.

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