A Method of Developing Single Molecule DNA Nanoparticles as Diagnostic and Therapeutic Agents

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BACKGROUND

Current nanoparticle-based approaches for treating disease include constructs composed of polymer, silica, gold nanoparticles, liposomes, or carbon nanotubes, to name a few. These structures are typically coated with a variety of functionalizing entities such as polyethylene glycol (to increase biocompatibility) and may be conjugated to various targeting peptides, antibodies, small molecules, or some form of therapeutic. A major disadvantage of these approaches is the need to develop complex conjugation chemistries for targeting specificity, biocompatibility, and drug incorporation by nanoparticles. Another limitation of this approach is the frequent requirement of additional clinical testing of the new nanoparticle coatings and entities.

DNA itself provides a simpler nanoparticle approach. One of the most thoroughly characterized molecules with regard to physical structure, chemistry, and modification, DNA may be employed as a scaffold for the integration of varying entities due to its well defined ability to base-pair hybridize. Also, DNA particles may be easily loaded with DNA-binding chemotherapy agents.

TECHNOLOGY DESCRIPTION

Leveraging DNA's inherently unique properties and ease of synthesis, a UC San Diego researcher has developed a methodology for the construction of large libraries of DNA nanoparticles and a process for the iterative selection of particles with desired properties. When coupled with DNA's other structural, functional, chemical, and informatic properties, this technology permits the efficient customization of multifunctional particles for biomedical and therapeutic use. Leveraging DNA's near anti-body specificity, practically non-toxic biocompatibility, and other desired properties, this technology provides a powerful approach for designing custom targeted therapeutics and diagnostic probes in a variety of applications.

ADVANTAGES

- Offers a powerful therapeutic platform based on DNA—a molecule approved for *in vivo* human use.
- Avoids the conjugation chemistries typically associated with conferring target specificity, biocompatibility, and drug incorporation.
- Provides a multifunctional platform for integrating many cancer therapeutic techniques.

STATE OF DEVELOPMENT

This platform technology is offered exclusively or nonexclusively for U.S. and/or worldwide territories. A commercial sponsor for potential future research is sought.

RELATED MATERIALS

- Dr. Bradley T. Messmer is an assistant project scientist at the Rebecca and John Moores Cancer Center at UC San Diego. Professor Messmer received his B.S. from the Colorado School of Mines in 1993 and a Ph.D. from Rockefeller University in 2000.
- Marciniak JY, AC Kummel, SC Esener, MJ Heller, BT Messmer (2008) Coupled rolling circle amplification loop-mediated amplification for rapid detection of short DNA sequences. BioTechniques 45(3):275–280.

PATENT STATUS

Country	Type	Number	Dated	Case

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

- **Medical**
  - Diagnostics
  - Disease: Cancer
  - Other

RELATED CASES

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United States Of America	Issued Patent	8,895,242	11/25/2014	2008-237	

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