Cooperative DNA Probing Using Chemically-Modified Oligonucleotides

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We have already shown that the several DNA conjugates hybridize to the adjacent sites on a target in highly cooperative manner. Focusing attention on the cooperativity, we proposed the DNA probing system of next generation. The probes (DNA conjugates) bearing various auxiliary chemical groups such as metal chelator and photo reactive groups are synthesized. By combined use of multiple probes, we can design more sophisticated systems for gene analysis than that expected for sole use of single probe.

Colorimetric multiplex SNP typing using cooperative formation of luminous lanthanoid complexes

EDTA and 1,10-phenanthrorine (Phen) were covalently attached to oligonucleotides (ODNs) to form the conjugate probes, capture and sensitizer probes, respectively. The sequences of the conjugates were designed so as to form a tandem duplex with target with their auxiliary units facing each other, providing a microenvironment to accommodate Ln^{3+}. Time-resolved luminescence studies showed that the formation of the luminous ternary complexes, EDTA/Ln^{3+}/Phen, highly depended on the sequence of the targets.

Photochemical ligation between anthracene-modified oligonucleotide probes

Anthracene readily forms photoadducts (anthracene dimers). The reaction generally requires close proximity and certain spatial alignment of both reaction partners. DNA could provide an ideal scaffold for accelerating the reaction, photocyclic addition. We synthesized a number of anthracene-ODN conjugates. The sequences of the conjugates were designed to bind adjacent sequences of the template with the anthracene units directed such that they stacked with each other. The conjugates were only dimerized in the presence of the template by light irradiation. The efficiency of dimerization was dependent on the structure of the conjugates and affected by one-base displacement in the template sequence.