CHAPTER 12
DNA Nanotechnology

INTRODUCTION

The use of nucleic acids and nucleic acids analogs as components of nanoscale devices has recently attracted considerable attention. Their highly specific self-assembling properties coupled with their potential for synthetic remodeling provide the opportunity to use nucleic acid–related substances as scaffolds as well as functioning components of mechanical, electronic, or photonic devices. This chapter will provide a means to highlight advances in the field and provide detailed protocols for some of the potentially more useful applications.

To initiate the chapter, one of the pioneers of the field, Nadrian Seeman, provides a perspective of the advances in his laboratory. In *UNIT 12.1*, "Key Experimental Approaches in DNA Nanotechnology," Dr. Seeman describes the construction of supramolecular structures based on DNA self-assembly. Important issues concerning synthesis strategy, junction design, and branching motifs are described. The characterization of complex DNA supramolecular structures is discussed in detail. This information provides important guidelines for future experimenters pursuing the construction of self-assembling supramolecular structures based on nucleic acids.

In *UNIT 12.2*, "Preparation of Gold Nanoparticle-DNA Conjugates," Andrew Taton provides experimental protocols for the preparation of gold nanaparticles containing a single tethered oligonucleotide as well as gold nanoparticles completely coated with a dense layer of oligonucleotides. The unit includes protocols that provide specific guidelines for the preparation of the different size nanoparticles as well as their characterization and properties. Recent research on gold nanoparticle–linked oligonucleotides suggests that they may be of significant use as components of hybridization-based diagnostic probes.

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