

Preface

The goal of this brief is to give a summary of recent advances in “Quantum Dots for DNA Biosensing.” Deoxyribonucleic acid (DNA), as the genetic information carrier, encodes all the genetic instructions used in the development and functioning of all known living organisms (bacteria, plants, yeast, and animals) and even many viruses. Due to its important function, the DNA-related detections are important for many applications in clinical diagnosis, homeland defense, and environment monitoring. Particularly, with the rapid development of nanotechnology, the sensitive, selective, and multiplexed analysis of gene sequences and quantification of target sequences have been realized. Among many of these analytical methods, quantum dots (QDs or Qdots) play a vital role in these applications. QDs have attracted great interests from researchers because of their excellent fluorescent, electrochemical and photoelectrochemical properties, which could be potentially and actually have been widely applied in various research areas ranging from in vitro biosensing to intracellular and in vivo imaging.

This brief focuses on special applications of QDs in DNA biosensing based on their fluorescent, electrochemical, photoelectrochemical, and electrochemiluminescent properties. Details of the preparation and functionalization of quantum dots as well as the fabrication of DNA biosensors have also been introduced here. We summarize how their properties can be used in DNA biosensor design with examples. Furthermore, we show some new emerging quantum dots such as silicon dots, carbon dots, and graphene dots as well as an important alternative to QDs, metal nanoclusters and their applications in DNA biosensing after introducing the limitations of traditional QDs. This brief is suitable to be used as a supplement for graduate-level courses in analytical chemistry, life science, biochemistry, biotechnology, biomedical engineering, etc. It may also help young scientists to get an overview of this topic.

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Quantum Dots for DNA Biosensing

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2013, VIII, 91 p. 41 illus., 22 illus. in color., Softcover

ISBN: 978-3-642-44909-3