Preface

The broad field of nanotechnology has undergone explosive growth and development over the past five years. In fact, no field in the history of science has experienced more interest or larger government investment. Indeed, by the end of 2006, the worldwide government and private sector investment in nanotechnology is projected to be approximately $9 billion. The enthusiasm researchers have for this field is fueled by: 1) the desire to determine the unusual chemical and physical properties of nanostructures, which are often quite different from the bulk materials from which they derive, and 2) the potential to use such properties in the development of novel and useful devices and materials that can impact and, perhaps even transform, many aspects of modern life.

The subfield known as Nanobiotechnology holds some of the greatest promise. This highly interdisciplinary field, which draws upon contributions from chemistry, physics, biology, materials science, medicine and many forms of engineering, focuses on several important areas of research. Some of these include: 1) the development of methods for building nanostructures and nanostructured materials out of biological or biologically inspired components such as oligonucleotides, proteins, viruses, and cells; these structures are intended for both biological and abiological uses, 2) the utilization of synthetic nanomaterials to regulate and monitor important biological processes, and 3) the development of synthetic and soft matter compatible surface analytical tools for building nanostructures important in both biology and medicine. Advances in this field offer novel and potentially useful approaches to building functional structures including computational tools, energy generation, conversion and storage materials, powerful optical devices, and new detection and therapeutic modalities. Indeed, advances in Nanobiotechnology have the potential to revolutionize the way the medical community approaches modern disease management.

Although the field is still embryonic, major strides have been made. Powerful new forms of signal amplification have been realized for both DNA and protein based detection systems. Indeed, the first commercial molecular diagnostic systems that rely upon nanoparticle probes are expected to be available in 2007. Biological labels based upon nanocrystals are commercially available and used routinely for research purposes in laboratories worldwide. Many new nanomaterials have boosted the efficacy and viability of several powerful pharmaceutical agents.

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