NANOBIOMEDICINE

FUNDAMENTALS AND IMPLEMENTATION IN THERANOSTIC APPLICATIONS

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CHAPTER 1

Fundamentals of Nanomedicine

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Abstract: Nanomedicine is a multidisciplinary field merging nanotechnology with medicine to address complicated health challenges at the cellular and molecular levels. The fundamental theory involves operating with materials at the nanoscale (1-100 nanometers), where distinctive physical, chemical, and biological characteristics become apparent. These nanoscale substances can interact with cellular systems in novel ways, allowing precise diagnostics, selective drug delivery, and novel therapeutic methods. Key developments include the progress of nanoparticle-derived delivery systems that enhance the bioavailability and singularity of treatments, decreasing side effects. Nanobiomedicine also plays a crucial role in evaluation and diagnostics, where nanosensors and imaging agents enable the early detection of diseases, including cancer and other infectious diseases. Additionally, nanotechnology has potential in regenerative medicine and tissue engineering, where nanomaterials help in tissue repair and cell growth. Recent advancements, for instance, the incorporation of nanorobots for minimum invasive processes and the utilization of biocompatible nanostructures for customized medications, highlight the revolutionary potential of nanobiomedicine. Although challenges like ethical concerns, toxicity, and regulatory obstacles must be recognised for widespread clinical application, with continuous research, nanobiomedicine promises to transform healthcare, providing more potent, personalized, and reduced invasive medical solutions.

Keywords: Cancer therapy, Diagnostic imaging , Nanomedicine , Nanoparticles, Regenerative medicines, Targeted drug delivery.

INTRODUCTION

Definition and Scope: Nanomedicine is a multidisciplinary field of science that includes physics, chemistry, engineering, biology, medicine, and allied sciences for the detection and treatment of diseases with the help of nanotechnology. The

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