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Implications of Nanotechnology in Ameliorating Cancer

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Despite medical advances, cancer is still one of the most dreaded disorder. Surgery, chemotherapies and radiotherapies have typically been the preferred form of treatment. However, their limited solubility and unstable nature hinder their widespread application. Drug resistance, hair loss, and the destruction of healthy cells are all frequent side effects. Nanotechnology provides new cancer treatment options in this regard and have emerged as an efficient platform in targeting chemotherapies to malignant cells and neoplasms particularly. It has also been known to improve the therapeutic efficacy of radiation based and other modern treatment modalities. All these factors tend to lower the risk of a patient suffering from cancer, thereby increasing its survival.

Research on cancer therapy using nanotechnology extends beyond the development of existing drugs to create new ones that are only made possible by the special properties of nanomaterials. Despite being much smaller than cells, nanoparticles are large enough to hold a variety of microscopic substances. Additionally, ligands like small molecules, DNA or RNA strands, peptides, aptamers, or antibodies can be employed to functionalize the relatively large surface area of nanoparticles. These characteristics allow the targeted delivery of many drugs with theranostic action. Their physical characteristics such as energy absorption and re-radiation can also be employed to destroy malignant cells.

By enabling therapeutic substances to be enclosed in nanoparticulate materials and delivered specifically to tumours via passive permeation and active internalisation mechanisms, nanomedicine technologies have paved the way for revolutionary targeted cancer therapies. One of the biggest barriers to traditional therapy, resistance, has been discovered to be reduced by employing nanotechnology for therapeutic purposes. Many cancer treatments using nanomedicines are already available on the market, and many more are in advanced stages of development and clinical testing. These treatments use a variety of nanosystems, including metallic nanoparticles, liposomes, quantum dots, carbon nanotubes, polymeric micelles, and nanospheres.