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The New Phase in Bacteria-Based Drug Delivery Therapies using Nano Biomaterials

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DESCRIPTION

Bacteria began to play a part as a new type of cancer treatment over a century ago. Researchers are currently focused on the potential links between host-microbe interactions and human health/disease. In recent years, microbial treatment has been regarded as a therapeutic technique for a variety of disorders, including many probiotics, live bacteria, as well as their derivatives and metabolic products, in acknowledgment of their major role. With significant developments in nanotechnology and biotechnology, the study and development of medication delivery systems based on these bacteria has grown rapidly in recent decades. Advances in genetic engineering methods have enabled the insertion of plasmid vectors expressing proteins such as antigens, antibodies, cytokines, and enzymes into living bacteria. Attenuated pathogenic strains have demonstrated more diversified applicability among these genetically altered bacteria.

They have been utilised as tumor-targeting carriers, for example, or for other particular tasks with low toxicity. Because of advances in physicochemical and biological technology, surface decorated bacteria may now be employed as drug delivery vehicles in the treatment of a wide range of illnesses, including cancer, inflammation, and metabolic disorders. Aside from using live bacteria directly, bacterial derivatives such as bacterial ghosts, bacterial outer membrane vesicles, and bacterial secretions have lately emerged as intriguing vaccination techniques for antibacterial treatment. This special theme issue attempts to give a more complete picture of bacteria-based vehicles for therapeutic payload delivery. Bacterial-derived particle developments, such as bacterial ghosts, minicells, and bacterium membrane vehicles, have been studied, as have their applications in the treatment or prevention of numerous illnesses. The creation and implementation of genetically altered bacteria, particularly comprehensive genetic engineering and synthetic bioengineering methodologies for strain modification. From another angle, advances in physicochemical and biological technology for surface decorating of individual bacteria and a full description of diverse uses of surface-modified bacteria as therapeutic agents and drug carriers are discussed.

Aside from developments in living bacterial treatments, Bacterial Membrane Vesicles (BMVs) have proved extremely effective in disease prevention and therapy. BMV therapeutic platforms that have been modified for the development of vaccines and immunotherapeutic methods against infectious illnesses and cancer. BMV production, kinds, modification techniques, and therapy regimens are all detailed. A growing number of studies have recently emphasized the therapy potential of bacterial therapies in a variety of conditions, including cancer, inflammatory diseases, and metabolic disorders. Tumors are described as the most prominent example, and this section offers an overview of the building techniques, use, benefits, current obstacles, and future prospects of engineered bacteria and their derived therapeutic systems in antitumor therapy. Specifically, it focuses on the advancement of bioengineered and functionalized *Salmonella Typhimurium*, one of the most extensively researched bacterial species for cancer treatment. The tumour microenvironment is intimately linked to tumour progression. Natural bacteria-based anticancer systems' techniques for modulating tumour microenvironment from the standpoint of components and friendly qualities. Furthermore, bacteria-specific molecular imaging is critical in confirming the proper transport of bacteria to the target lesion and tracking therapy response. Jung Min discusses the present state of bacterial imaging techniques, the benefits and drawbacks of various imaging modalities, and future targets for bacterial imaging and associated applications. Initiating medication release in specific tumour locations remains a difficult challenge. By grafting reduction-responsive Camptothecin (CPT) prodrug copolymer onto Prussian blue nanoparticles and then modifying with cRGD ligand to recognise v^3 integrin and hyaluronic acid, researchers created a multifunctional nanoparticle system to bind the CD 44 receptor on the surface of tumour cells. The resulting dual-targeting nanoparticles had high photothermal conversion efficiency and a glutathione act vatable CPT release profile. The nanoparticles were also used in photoacoustic imaging-guided chemo-photothermal treatment for breast cancer. Glioblastoma (GBM) is an aggressive primary brain tumour with a high recurrence rate. One of the major obstacles for anti-glioma therapy is the inefficiency of chemotherapeutic medicines in crossing the Blood Brain Barrier (BBB). TAMs further impair medication effectiveness in glioblastoma. Created a lipid-small molecule hybrid nanoparticle for imaging and therapy in an orthotropic GBM tumour model to take use of the benefits of liposomes and solid nanoparticles. LPHNPs significantly increased drug-loading capacity and formulation stability when compared to physical encapsulation with traditional liposomes. LPHNPs have low system toxicity, improved photodynamic treatment efficacy, and visualization capabilities for drug biodistribution and tumour imaging. Furthermore, the hybrid LPHNPs nanoparticle exhibits good curative effects in greatly extending the survival of mice with orthotropic glioma, demonstrating the potential of the hybrid LNP system to increase drug delivery efficacy and potentiate cancer therapy.