SCIENTIFIC PUBLICATION

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Novel Biomaterial-based technologies for brain anti-cancer therapeutics.
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ABSTRACT

Treating malignant brain tumors represents one of the most formidable challenges in oncology. Contemporary treatment of brain tumors has been hampered by limited drug delivery across the blood–brain barrier (BBB) to the tumor bed. Biomaterials are playing an increasingly important role in developing more effective brain tumor treatments. In particular, polymer (nano)particles can provide prolonged drug delivery directly to the tumor following direct intracerebral injection, by making them physiochemically able to cross the BBB to the tumor, or by functionalizing the material surface with peptides and ligands allowing the drug-loaded material to be systemically administered but still specifically target the tumor endothelium or tumor cells themselves. Biomaterials can also serve as targeted delivery devices for novel therapies including gene therapy, photodynamic therapy, anti-angiogenic and thermotherapy. Nanoparticles also have the potential to play key roles in the diagnosis and imaging of brain tumors by revolutionizing both preoperative and intraoperative brain tumor detection, allowing early detection of pre-cancerous cells, and providing real-time, longitudinal, non-invasive monitoring/imaging of the effects of treatment. Additional efforts are focused on developing biomaterial systems that are uniquely capable of delivering tumor-associated antigens, immunotherapeutic agents or programming immune cells in situ to identify and facilitate immune-mediated tumor cell killing. The continued translation of current research into clinical practice will rely on solving challenges relating to the pharmacology of nanoparticles but it is envisioned that novel biomaterials will ultimately allow clinicians to target tumors and introduce multiple, pharmaceutically relevant entities for simultaneous targeting, imaging, and therapy in a unique and unprecedented manner.