Carbon Nanoparticles for Drug Delivery and Treatment of Traumatic Brain Injury, Stroke, and Autoimmune Diseases

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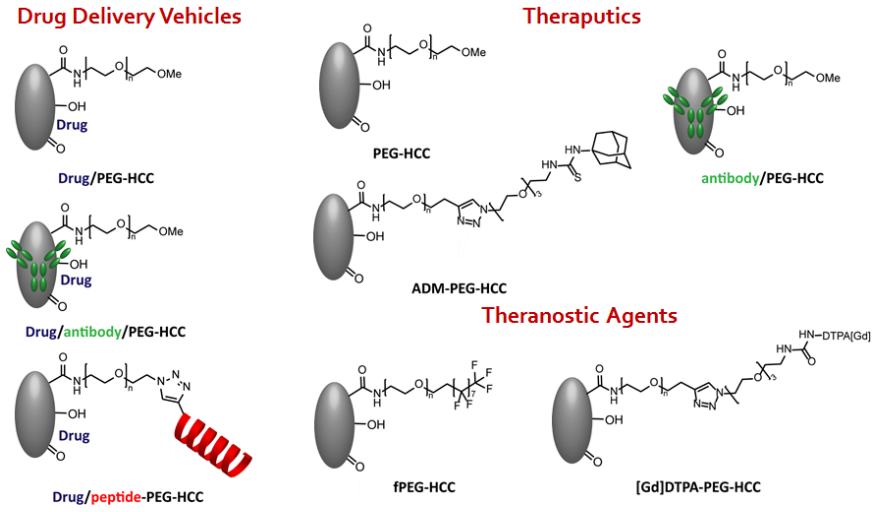
Idea:

Oxidative stress is a hallmark for several acute and chronic pathologies and is caused by an excessive accumulation of reactive oxygen species (ROS) in tissues. The poor clinical efficacy of current antioxidant therapy has led our group to prepare a new class of nanoparticle antioxidant called poly(ethylene glycol)-functionalized hydrophilic carbon clusters (PEG-HCCs).

PEG-HCCs show high capacity to annihilate ROS such as superoxide and hydroxyl radicals, show no reactivity toward the nitric oxide radical, and can be functionalized with targeting moieties without loss of activity. Given these properties, we propose that PEG-HCCs offer an exciting new area of study for the treatment of numerous ROS-induced human pathologies such as cancer, heart disease and traumatic brain injury.

Current Strengths:



PEG-HCCs are unique antioxidants due to their high antioxidant capacity, the possibility of catalytic behavior, non-reliance on detoxifying enzymes, targetable via simple mixing with antibodies, and carry additional drug payloads. The figure above shows 3 categories of PEG-HCCs designed by the Tour group: drug delivery vehicles, therapeutics, and theranostic agents.

Investment needed to support growth:

Clinical translation of these formulations requires investment in pre-clinical *in vitro* and *in vivo* studies of PEG-HCCs to determine their efficacy in mitigating the effects specific diseases.

Potential impact:

These materials represent a new platform technology in treating several pathologies using targeted antioxidant therapy with PEG-HCCs. The impact of these nanomaterials will be significant and will change the direction of current pharmaceutical development.