'Trojan horse' proteins are step forward for nanoparticle-based anti-cancer and anti-dementia therapeutic approaches

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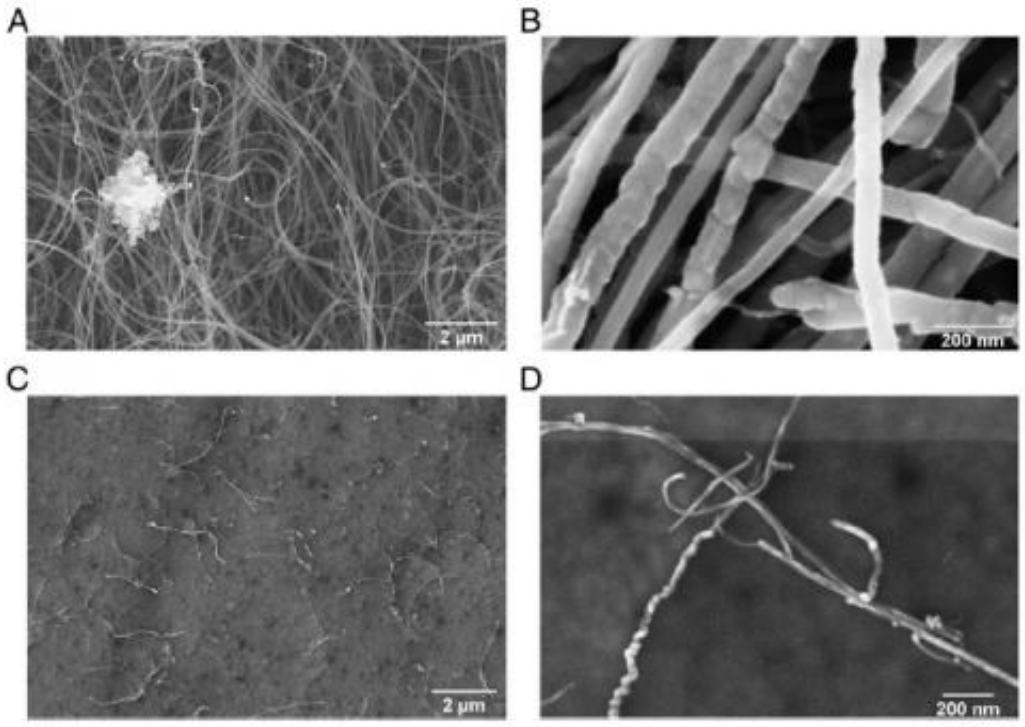

Scanning electron microscopy images of pristine (A and B) and CMC-coated (C and D) Fe-MWNTs showing high purity of the pristine samples and high dispersion of the functionalized samples. The dispersions are very stable (non-sedimenting).

Scientists at Brunel University London have found a way of targeting

hard-to-reach cancers and degenerative diseases using nanoparticles, but without causing the damaging side effects the treatment normally brings.

In a huge step forward in the use of nanomedicine, the research helped discover proteins in the blood that disguise nanoparticles so they are absorbed into cells without causing inflammation and destroying healthy cells.

Two studies, Complement activation by carbon nanotubes and its influence on the phagocytosis and cytokine response by macrophages and Complement deposition on nanoparticles can modulate immune responses by macrophage, B and T cells, found that carbon nanotubes (CNTs) triggered a chain reaction in the complement system, which is part of the innate immune system and is responsible for clearing pathogens and toxins.

The team, led by Dr Uday Kishore of the Centre for Infection, Immunity and Disease Mechanisms, found the entire complement system was activated, from C1 at the start to C5 at the end. This in turn activated the cell-killing membrane attack complex.

In principle, this should have caused an acute allergic, inflammatory reaction. However the opposite was true.

The interaction between CNTs and C1q (a starter-protein for complement) was anti-inflammatory. This suggests that either coating nanoparticles or healthy tissue with complement proteins could reduce tissue damage and help treat inflammatory diseases like Parkinson's, Huntington's, ALS and Alzheimer's.

It was not clear if the binding between complement proteins and CNTs was direct or indirect. However, changing the surfaces of CNTs affected how likely the complement system was to be activated and in what way.

Using the data from this study, carbon nanoparticles coated with genetically- engineered proteins are being used to target glioblastoma, the most aggressive form of brain tumour.

Dr Uday Kishore, from Brunel University London's College of Health and Life Sciences, said: "By using a protein recognised by the immune system to effectively disguise carbon nanoparticles, we will be able to deploy these tiny particles to target hard-to- reach areas without damaging side effects to the patient. This is a big step forward. It is like understanding how to use penicillin safely and could be as revolutionary to modern medicine as its twentieth century predecessor."

More information: "Complement activation by carbon nanotubes and its influence on the phagocytosis and cytokine response by macrophages." *Nanomedicine: Nanotechnology, Biology and Medicine* www.nanomedjournal.com/article/S1549-9634%2814%2900112-9/fulltext

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