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## 第67回 GMSI公開セミナー

**Engineering the Pharmacology and Toxicology of Nanomaterials:  
The Case of Carbon Nanotubes**Professor **Kostas Kostarelos**

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**要旨**

A lot of effort is currently invested in the development of various types of nanomaterials such as quantum dots, metallic and semi-conducting nanoparticles, carbon nanotubes (CNT), all designed for a variety of biomedical applications. Carbon nanotubes in particular differ dramatically in terms of structural characteristics (diameter, length, size distribution), surface (chemical composition of coated or grafted groups, aspect ratio, hydrophobicity) and colloidal properties (degree of aggregation, dispersibility). These differences result in diverse biological profiles *in vitro* and *in vivo*. Even within the same type of CNT dramatic structural, surface and chemical differences exist based on manufacturing or chemical treatment specifications that will determine their biological profiles *in vivo*. This leads to the need for very careful determination of the material characteristics and their correlation with pharmacological performance and any adverse effects that may occur.

The nanometer-scale dimensions of CNT make quantities of milligrams possess a large number of cylindrical, fibre-like particles, with a concurrent high total surface area. The large aspect ratio will also depend on their degree of bundling and aggregation of nanotubes in solution. Concerning the toxicity of CNT, *in vitro* studies have indicated that chemically functionalised CNT produce less cytotoxic effects than aqueous dispersions of pristine CNT (non-covalently functionalised). However, the toxicity of CNT does not only depend on the degree of surface functionalisation and the different toxicity of functional groups. Batches of pristine CNT (non-purified and/or non-functionalised) readily after synthesis contain impurities such as amorphous carbon and metallic nanoparticles (catalysts: Co, Fe, Ni and Mo), which can also be the source of toxic effects have been reported in studies using pristine CNT. In this talk, specific examples of engineering carbon nanotube material to achieve control over their pharmacology (localisation and retention in specific tissues) on administration and their toxicological impact will be shown. Such engineering exercises are considered essential for the development of CNT in medicine.

主催: 東京大学グローバルCOEプログラム「機械システム・イノベーション国際拠点」  
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