# Carbon materials for drug delivery & cancer therapy

**Carbon nanotubes and graphene are both low-dimensional $sp^2$ carbon nanomaterials exhibiting many unique physical and chemical properties that are interesting in a wide range of areas including nanomedicine. Since 2004, carbon nanotubes have been extensively explored as drug delivery carriers for the intracellular transport of chemotherapy drugs, proteins, and genes. *In vivo* cancer treatment with carbon nanotubes has been demonstrated in animal experiments by several different groups. Recently, graphene, another allotrope of carbon, has also shown promise in various biomedical applications. In this article, we will highlight recent research on these two categories of closely related carbon nanomaterials for applications in drug delivery and cancer therapy, and discuss the opportunities and challenges in this rapidly growing field.**

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**In the past decade, the rapid development of nanotechnology has brought many fascinating ideas and opportunities to disease diagnosis and treatment. $sp^2$ carbon nanomaterials, notably zero-dimensional (0D) fullerenes, 1D carbon nanotubes (CNTs), and 2D graphene, have gained significant interest from various fields and generated huge impacts in the materials research community since their discovery in 1985, 1991, and 2004, respectively[1-3]. Graphene is a mono-layered $sp^2$-bonded carbon sheet. Single-walled carbon nanotubes (SWNTs) and multi-walled carbon nanotubes (MWNTs) are cylindrical tubes of $sp^2$ carbon, conceptualized by rolling up single- or multi-layered graphene, respectively. Potential applications of these carbon nanomaterials span disciplines including nano-electronics, composite materials, energy research, and biomedicine[4-9].**

Fullerenes and their derivatives can serve as drug delivery vehicles, and in certain circumstances, as nano-drugs by themselves[10-12]. CNTs have been developed as novel biosensing platforms to detect different biological targets and as nano-probes for biomedical imaging[8,13,14]. Functionalized CNTs can be used as molecular carriers for *in vitro* and *in vivo* drug delivery, and have been primarily employed for applications in cancer treatment[8]. Recently, graphene, a rising star in the materials science community, has also attracted increasing interest



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