

**Nanomedicine:  
Fullerene and Carbon Nanotube Biology**

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The direct application of nanoscale materials to biological targets is now yielding promising applications in medicine.[1] This talk will review the field of fullerene and carbon nanotube biology, as well as describe current applications of fullerene derivatives in biology and medicine.[2]

The flexible chemical reactivity of fullerene-  $C_{60}$  has already resulted in numerous fullerene compounds that are now available for study. In addition, at 7.2 Å in diameter,  $C_{60}$  is similar in size to steroid hormones or peptide alpha-helices, and thus fullerene compounds are ideal molecules to serve as ligands for enzymes and receptors.

Other fundamental physical and chemical properties of fullerenes govern how they may be adapted for biological use. While fullerene- $C_{60}$  itself shows no solubility in water, many fullerene compounds can be very water soluble. Such derivatives of  $C_{60}$  contain polar side chains and, as a general rule, the greater the number of polar groups the greater the water solubility. In order to maximize the chances of advantageous adsorption and distribution properties of bioactive compounds, it is generally accepted that there are certain desirable ranges of lipophilicity and several fullerene compounds have already been reported that are in favorable therapeutic ranges

Numerous useful fullerene-based therapeutics have already been developed, including anti-viral agents, neuroprotective agents, and anti-cancer drugs, as well as biosensors for diagnostic applications. The use of these fullerene-based nanoscale products for pharmaceuticals and for medical device applications will be discussed, including the advance of fullerene-based therapeutics to human clinical trials.[3,4]

References:

- [1] Robert A. Frietas, Jr., "Nanomedicine, Volume 1" Basic Capabilities," Landes Bioscience, 1999.
- [2] Wilson, S. R. "Biological Aspects of Fullerenes," in Fullerenes: Chemistry, Physics, and Technology, Kadish, K. M.; Ruoff, R. S. (eds), John Wiley & Sons, New York (2000).
- [3] "Nanotechnology in Biology: The Good of Small Things," The Economist, Dec 22, 2001. [[http://www.economist.com/science/displaystory.cfm?story\\_id=916725](http://www.economist.com/science/displaystory.cfm?story_id=916725)]
- [4] <http://www.csixty.com>