

## NANO HIGHLIGHT

### Designer Nanotubes Made to Order -Any Material, Any Property, Any Shape NIRT for Biomedical Nanotube Technology

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We are conducting the first-ever broad-based and systematic research effort on the development of nanotube technology for biomedical applications. The nanotubes are prepared by the template-synthesis method. This extraordinarily versatile approach for preparing nanotubes was pioneered in the PI's laboratory. It has become one of the workhorse nanotube-synthesis methods and is now practiced in laboratories throughout the world. The key advantage of template synthesis is that nanotubes composed of nearly any material or combination of materials can be prepared. This is an extremely important attribute because with template synthesis, *the materials to be used to prepare the nanotubes can be selected so that they are perfectly and ideally suited for the biomedical/biotechnological application at hand.* Put another way, with template synthesis, one can make "designer nanotubes" (Table 1).

Table 1. The concept of template-synthesized designer nanotubes - Some materials that have been used to make designer nanotubes and the key properties that make these nanotubes useful.

Material	Properties
Metals	Electronic properties, tunable optical properties, magnetic properties.
Semiconductors	Electronic properties, photochemical activity.
Polymers	Tunable electronic, optical, solubility, and mechanical properties,
Biodegradable polymers	Biodegradability,
Biocompatible materials	Biocompatibility,
Silica	Easy chemical and biochemical functionalization, transport properties.
Carbons	Electrochemical properties, transport properties, electrokinetic phenomena.

The shape of the template-synthesized nanotubes can also be controlled at will. For example, conical nanotubes prepared by the template method are shown in Figure 1. **No other nanotube synthesis strategy offers the amazing versatility of template synthesis.**

**Figure 1. Scanning electron micrographs of three conical gold nanotubes prepared by the template method.**

