

NANO IN THE MOVIES

Science and engineering topics appear in many movies – think of the gadgets in the **James Bond** series. *Star Trek*, *Star Wars*, and other long-standing science fiction series, of course, are full of futuristic transportation, infrastructure, devices and weapons.



Mmmm... replicated martini. image from *Star Trek: The Next Generation* (1988)

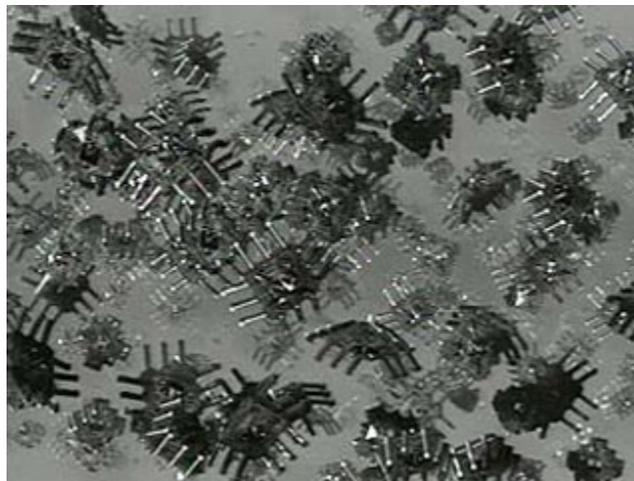
The word “nanotechnology” was coined in 1974 by Norio Taniguchi¹, and it began appearing in the media in the mid-1980’s. Hollywood took a while to catch up, but nanotechnology has appeared in a variety of films and TV shows. One of the more famous films is the 2002 *Spider-Man*. Peter Parker, upon meeting Dr. Norman Osborn for the first time, says that he is a fan of Dr. Osborn’s work on nanotechnology.



“I read all your research on nanotechnology.” Peter Parker (Tobey Maguire, left) geeks out at Norman Osborn (Willem Dafoe). image from *Spider-Man* (2002)

Sadly, we never get to hear what this nanotechnology research was all about. But as Dr. Osborn’s experimental technology later transforms him into the villainous Green Goblin, it clearly had a dark side.

Most of the time, unfortunately, nanotechnology shows up in film as force for evil. A good example is *Star Trek: First Contact* (1996). In this movie, the villainous Borg attempt to take over Earth and assimilate all of its citizens into their collective Hive Mind, by the injection of “nanoprobes” into their victims. These nanoprobes latch onto blood cells and re-write the victim’s DNA.



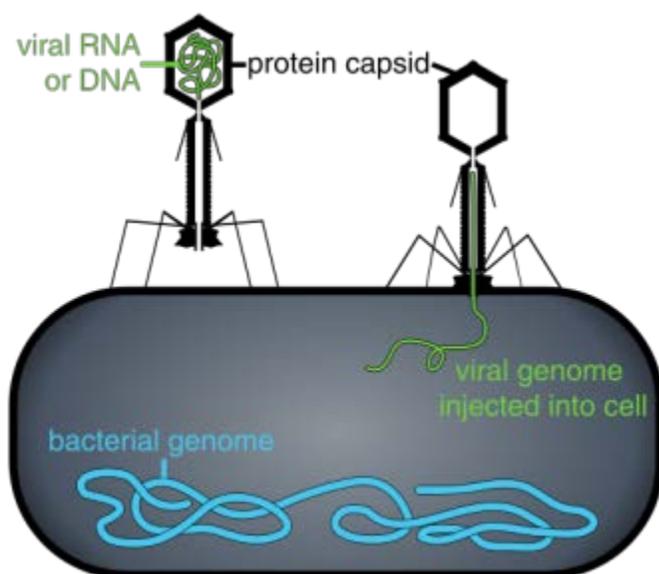
Borg nanoprobes, unfortunately shown without scale bar. image from *Star Trek: Voyager* (1997)

How does the real science match up with these fictional plotlines? It is true that scientists can put DNA or RNA on nanoparticles and use these introduced nucleic acids to control gene expression in living cells.^{2,3} The

general idea is that the introduced nucleic acid will find its complementary DNA or RNA target in the cell, bind to it, and turn off gene expression by blocking anything else from binding there. You can see that this could be a force for good, if “bad” genes are turned off.

Recently, biologists have also shown that they can, to some extent “rewrite” the DNA in plants.⁴ Basically, breaks in the DNA double helix can be produced, and new genetic material can then be stitched in as the cell repairs the DNA. How far this can go is a hot topic in many research labs around the world. So far, nanotechnology has not played much of a role in this line of research – but you can see how it might!

But aside from nanotechnology, we already have a natural version of the Borg’s “nanoprobes”: **viruses**. Viruses are naturally occurring nanoscale objects that insert their own DNA or RNA into host cells, and use the cells’ machinery to replicate themselves. There are medical applications being developed to take advantage of this property of viruses. For example, research is underway to try to use viruses to destroy cancer cells.^{5,6}



Much like fictional nanoprobes, real viruses can hijack cells by inserting their own DNA or RNA

Whether manufactured like “nanoprobes,” or found in nature like viruses, nanotechnology has great potential in a variety of applications in biology and medicine. These applications include drug delivery, new ways to image cells, and chemical sensing. The promises of nanotechnology are many; yet the dangers, as amplified by examples from movies and TV, might loom larger in the public mind. One of our goals as the **Center for Sustainable Nanotechnology** is to understand the fundamentals of the interactions between nanoparticles and living systems (cells and organisms). Only with deep understanding will we be able to counteract any potential Borg scenarios!

Source : <http://sustainable-nano.com/2015/02/12/nano-movies/>