

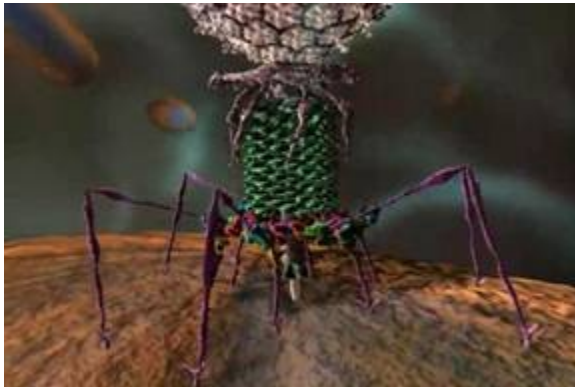
Nano-machines Are NOT New!

Jeffrey R. Harrow
Principal Technologist, The Harrow Group

Unfortunately, we experience the results of certain nanomachines all too often -- and we usually don't much like the results!

These nanomachines are not the product of some laboratory (at least not yet); they are Nature's "viruses."

Now, thanks to the Aug. 30, 2004 [MSNBC](#) and a [National Science Foundation Press Release](#), we find out that our knowledge of these natural nanomachines is expanding. And that makes me feel rather sure that we will (eventually learn to both tame, and to harness these simplest forms of life.



I know that this picture from the MSNBC article cited above looks like the worst of what a sci fi flick might present, but this is a rendition of a "T4 bacteriophage, based on actual high-resolution imagery of the virus" from work at Purdue University in collaboration with labs in Russia and Japan!

How It Works.

Taking a bit of a simplistic view, a virus isn't strictly alive; it's composed of a protein shell with a hollow center that contains the payload - the virus' nucleic acid composed of either DNA or RNA - that forces target cells to do its bidding.

The outside surface of the virus is studded with specific proteins that allow it to target and attach itself to the appropriate living host cell; it finds those cells by matching the cells' surface proteins with those of its own (a "lock and key" scenario). The virus then hijacks the cell by attaching to it and literally injecting its payload into the cell, causing the cell to reproduce the virus, which often kills the cell when it explodes to release the newly-created viruses. They then move on to seek out other cells, reproducing at an increasing rate. I know, this seems like some of the worst of science fiction, but it happens within our bodies every day!

www.futurebrief.com

It's easy to gain a good understanding of what takes place by watching an excellent animation of the process through a link at the top of the MSNBC page noted above.

What you'll see is a single virus that looks disturbingly like the Lunar Lander, complete with spider-like legs, that is seeking out an E. coli bacteria. Once the virus finds its target (which is common in the human colon) the virus' legs touch down and grip the cell membrane's surface. Next, the bottom of the virus irises open and a nano-needle pushes down towards the cell membrane. Pushing against the gripping force of the legs, the needle penetrates the cell wall and then injects its nucleic payload, which begins the hijacking.

Nanoscale Understanding Leads To Control.

Our increasing ability to examine things at the nanoscale is what led to this revelation of how viruses work. As you might expect, every shred of knowledge builds upon the previous ones to increase our understanding -- which may in turn lead to ways that we can control, or even turn the tables on and hijack our age-old virus nemesis, to our advantage. For example, now that scientists know how the viruses' legs attach, perhaps they can, figuratively, come up with a way to cut destructive viruses off at their tiny knees. That way, their legs could not attach to the cell and provide the resistance needed to enable its "needle" to poke through the cell wall. No injection, no reproduction!

Given the pain and suffering and death that viruses cause, we might all feel better if the day arrives when a visit to the doctor doesn't end with:

"...it's a virus, so there's really nothing we can give you. Of course if you had a bacterial infection, we could probably fix you right up."

Instead, the conversation might end with

"...it's a virus, so take these pills and you'll feel good again, fast."

And wouldn't that be nice.

It's All About Nanotechnology.

Just as this ability to "see" at ever-smaller scales has now allowed us to view how viruses work, our increasing ability to "do things" at this billionths-of-a-meter nanoscale has the potential to lead to solutions.

So the next time you catch a cold, or suffer from a more serious viral attack, think about how the fruits of such fundamental nanotechnology research, which spans many traditionally separate fields of science, might one day keep viruses, like bacteria today, at bay.

Learning from Nature, at its nanoscale of atoms and molecules, will change EVERYTHING. Those companies and countries that aren't at the forefront of this coming "Nano Age" will find themselves at an enormous competitive (and security) disadvantage. But WE intend to be the "winners" -- don't we?



www.futurebrief.com

This essay is original and was specifically prepared for publication at Future Brief. A brief biography of Jeff Harrow can be found at our main [Commentary](#) page. Other essays written by Jeff Harrow can be found at his [web site](#). Jeff receives e-mail at jeff@theharrowgroup.com. Other websites are welcome to link to this essay, with proper credit given to Future Brief and Mr. Harrow. This page will remain posted on the Internet indefinitely at this web address to provide a stable page for those linking to it.

To download a PDF version of this essay, [click here](#). Please feel free to share the PDF with others who may be interested. To hear about future **Commentary** essays, take a few seconds to read about [Daily Brief](#), one of the "briefest" Internet updates offered anywhere.

© 2004, Jeffrey Harrow, all rights reserved.