

## Who's afraid of nanotechnology?

By Pearl Chin, PhD, MBA

Despite all the new and improved goods and services nanotechnology will enable, the media seems to be playing up the negative aspects of nanotechnology. In the scathing May 6<sup>th</sup>, 2002 Wall Street Journal article by Lee Gomes, strong words of skepticism about the potential of nanotechnology were served up based on the opinions of a MEMS (micro-electronic mechanical systems) analyst.

However, asking a MEMS analyst about nanotechnology is like asking a gynecologist to comment on the latest techniques in brain surgery. MEMS is not the same as nanotechnology even though it's related on a larger scale. The analyst's denigrating comparison of nanotechnology innovation to commodity gas flow pressure regulators if anything at all was exaggerated and inaccurate but designed to be provocative. Nanotechnology is more likely to enable ultrahigh sensitivity sensors to detect radiation and chemical and biological weapons and as well as enabling cures for cancer. These innovations are a far cry from gas flow pressure regulators but that's not to say they aren't important as they are needed to regulate your anesthesia or control fuel mixtures in rockets. However, there's a big difference in the perceived value during application of ultrahigh sensitivity nanosensors as compared to that of commodity gas flow pressure regulators. In addition, the assertion that the current spending binge by governments on nanotechnology is being attributed to nothing more than some sort of ego spending war and one-upmanship on things that are a techno-fad and not basic science is also inaccurate.

Nanotechnology is based on science just like MEMS is based on science too. Not enough credit is being given to these countries' spending binges towards nanotechnology research that can prevent terrorist attacks or cure disease in their respective countries. Understanding where and why the research monies are being spent would prevent the majority of these shortsighted judgements. The so-called experts often feel they have to say something, even about things they know nothing about.

The problem is that no one person can be an expert in nanotechnology. It's just too broad and interdisciplinary a field. So beware of anyone who touts him- or herself to be an expert in nanotechnology. None of the media's stance is surprising as fear of the unknown has historically lead to demonization of a new phenomenon that is not well understood.

An article put out by the ETC Group (the action group on Erosion, Technology and Concentration) in their May/June 2002 issue is demanding an "immediate moratorium on commercial production of new nanomaterials". This article gives the impression that all nanotech is an environmental disaster waiting to happen. As well researched as this article is with plenty of heavy hitters from nanotechnology being cited in the bibliography, this is just plain misinformation structured in a way to scare the average person. They even quoted Vicki Colvin, a professor and also co-director of the Center for Biological and Environmental Nanotechnology at Rice University in Texas, out of context to add fuel to the fire.

The authors of this dangerous article seem unaware that nanoparticles occur naturally on Earth and have been used throughout human history (e.g. Roman ceramics) and produced industrially for decades. They worry about using nanotubes in car tires without noting that tires already contain carbon black, which is naturally occurring nanoparticulate carbon. This is as if someone wrote an article when composites materials and their research funding were hot and then demanded a moratorium on all composites research because it could be used to create vehicles for the purposes of war, such as tanks and fighter planes like the F16 or the Stealth Bomber. This is all forgetting that composite research also enables such items as bulletproof vests, tennis rackets, kitchen countertops, bicycles, golf clubs, automobile bodies and fiberglass surfboards and then demanding that all trees, since wood is a natural composite, should be cut down.

All this media attention is beginning to take on the extremist tones of some animal rights and some Greenpeace activists. I don't mean to offend animal rights or environmental protection activists because they do have some good points. However, it seems the implementation may need to be a little more to be desired as is in this case.

Articles like these are dangerous. The writers are deliberately misinforming the public, designing to be provocative, thus ending up with articles that mislead and scare the public. They are especially dangerous because an uninformed public doesn't realize the media has been doing this to science for decades. Scientists are very well aware that the media often quotes or misquotes them out of context to make a sensationalist and provocative article when the writer's lack of real understanding of the news makes the piece unable to stand up on its own without the scare tactics. That's why scientists hardly talk to the media and which is why the argument for having science writers with actual knowledge about science is probably a good idea.

And of course on the flip side, the media is always complaining that the scientists won't talk to them. This is exactly the same problem that Hollywood stars have trying to avoid the tabloids like the National Enquirer. You wouldn't want to talk with them or let them take your picture either if you knew, because they'd done it before, the next day they were going to paste some other person's face onto your spouse's in a picture for the front page of tomorrow's news.

Unlike stem cell research, which has huge ethical implications with cultivating stem cells and cloning issues, nanotechnology should not be quite so controversial. This is very problematic because it may, in this case, very well cause people to rise up in arms to pester their congressmen or universities against funding nanotechnology that could ultimately prevent their own cure for cancer. And I'm not trying to misinform you to scare you here. Scientists are much closer to cures for disease because of nanotechnology. Much closer than you think.

However, Lee Gomes is probably right to some degree about the hype problem. Hype, positive or negative, is created when something is not well understood and it often substitutes for passion when the knowledge base is not there. Dr. R. Stanley Williams of HP, one of the contributors to the government's National Nanotechnology Initiative is in so much angst about the dangers of hype to nanotechnology research that he was quoted about his mission to pop the nanotechnology bubble before it gets too big. Even this seems a bit extreme and reactionary although sometimes extreme situations demand extreme solutions. However, this is not one of those situations. It's not necessary to pop the bubble altogether. It's more important to have controlled growth of one. No need to throw the baby out with the bath water. There'll be a lot of unhappy babies in the bath water complaining about the loud pop from the bubble. Let's not let irrational exuberance or apathy cause us problems here too. Let's strive to strike a balance instead of going to extremes.

### **When there's money involved, the hype is real.**

Nanotechnology is the next big thing but everyone seems to think it's all hype. There's hype but it's not all hype. In the early stages of anything new, it's always important to have some hype. It's marketing and a necessary evil but usually we take this in stride. However, the bursting of the dot.com bubble still has left a bad aftertaste in people's mouths. Much of this hype has venture capitalists frozen in fear about investing in nanotechnology. However, VC's are just as at fault as the media for propagating the reputation of investing in hype. At the time, everyone was jumping on the Internet bandwagon afraid the internet ROI (return on investment) train was going to pass them by. To make sure opportunities didn't slip by, many firms cut corners on due diligence and threw the basic business fundamentals out the window wanting to believe it was a new economy while claiming that the old rules didn't apply anymore. The stock market is no stranger to this phenomenon with Enron and WorldCom leading the decay now. It was a time when it was just too easy to make money and now in the end, everyone got run over by the train instead of being on it. However, it can't be all hype if the governments of the world are spending hundreds of millions of dollars on nanotechnology research, much of which is for defense purposes and may not be from the NNI budget.

The government, starting with the Clinton administrations in 1993 and now with the Bush administration has been pumping \$3.7 billion over 4 years starting 2005 into nanotechnology research with the signing of S189 in December 2003. George W. Bush also approved \$849 million for 2004. According to the NNI, spending on commercial products begotten from nanotechnology will reach \$1 trillion per year in 10-15 years. The larger technical companies such as IBM, Motorola, Hewlett Packard, Lucent, Hitachi,

Mitsubishi, NEC, Corning, Dow Chemical, and 3M have launched nanotechnology research initiatives of their own, many of them collaborating with universities.

With all the money available, there will, of course, be a lot of exaggerated claims and scams. This is unavoidable. Greed has always been around, even "infectious greed" according to Alan Greenspan. Many companies are even changing their name to reflect their new nanotechnology directives to take advantage of all this money. Unfortunately, many of those companies have products that are not nanotechnology based and probably suspect as well. Even large companies like Bell Labs are not immune from accusations of scientific misconduct. They're now being investigated for exaggerated claims regarding nanotechnology research to be applied to create molecular transistors to replace traditional semiconductors. Clearly there are going to be bad nanotechnology investment opportunities too so how can they tell which ones are real and viable and which ones are not and which ones need to go back to the drawing board for more government funding?

The peer review system with which the scientific community uses to police itself no longer applies once the research moves into the commercial arena. Then it becomes "Buyer (Investor) beware".

It becomes obvious that the only way to avoid dealing with the hype is to make sure knowledgeable people are doing the technology assessment. In addition to determining which investment opportunities are real, it would be doubly useful to be able to determine if they have commercialization potential. Often a technology can be viable, but can it be viable within a reasonable time frame? These knowledgeable people need have not just breadth in nanotechnology understanding, which is critical, but also breadth in business and management experience.

Education and the right consultants will be very important in making sure we reap all the benefits of nanotechnology and minimize all the negative aspects of nanotechnology.

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