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## Nanomedicine: real commercial potential or just hype?

What is the real commercial potential for nanotechnology and, in particular, nanomedicine? Depends on your definition. For example, if you think nanomedicine refers to Michael Crichton's self-replicating nanorobots traversing the body and healing disease (as in his 2002 novel *Prey*), I bet you will be waiting a long time (if ever) to see commercial fruition. On the other hand, if you envision nanomedicine as listening to meditation music from your iPod nano (and, thus, healing your soul), then you are in luck as you are already experiencing commercial benefits of nanomedicine. If only you had bought the stock.

But if you are like the rest of us with a more reasonable interpretation of nanomedicine (the use of nanomaterials in medicine), you are somewhere in between. While it can be stated that medical fields (such as implants, imaging, diagnostics, drug delivery, etc) are experiencing varying degrees of nanomedicine success, it is safe to say they all are beginning to see commercialization. Products have emerged. These include various nanomaterials (nanoparticles, nanotubes, nanostructured materials, and nanocomposites), nanotools (nanolithography tools and scanning probe microscopes), and nanodevices (nanosensors and nanoelectronics) which are available commercially, some for human use. To some this may not sound significant, but consider for a moment the time span numerous government agencies around the world require for a new medical device for human use. When considering that new pharmaceuticals require up to 15 years of testing to get through the approval process (and this is just one example), it is clearly a significant advancement to even have nanomedicine products on the market.

Certainly, though, the promise of nanotechnology has created lofty expectations in some quarters. The expectations continue to grow from year to year. For example, the US National Science Foundation (as one example) has contributed to this hype. The US National Science Foundation is on record as predicting that the market for nanotechnology, or products containing nanotechnology, will reach US\$1 trillion in 10–15 years (<http://www.biz-lib.com>). Clearly, medical products will be a significant part of this expectation. With any new technology, both advocates and opponents of nanotechnology tend to lose sight of the fact that progress in developing commercial nanotechnology applications has been understandably slow to date, but the excitement is still as high (if not higher) than when nanomedicine emerged over 10 years ago.

Importantly too, expectations for nanomedicine remain high. The expected commercial potential has not decreased or even remained the same over the past decade, but has only increased. Some have predicted that nanomedicine will exhibit strong growth in all sectors until as far out as 2011, leading to multi-billion dollar revenues (<http://www.piribo.com>). Key nanomedicine technology platforms (such as nanocrystals, nanotubes, dendrimers, fullerenes, quantum dots, and molecular scaffolding) are expected to drive that market expansion (<http://www.piribo.com>). Few research fields have been able to sustain and grow such excitement that continues to drive nanomedicine.

So while in business and academia we are perpetually thinking of the future and asking what is the real commercial potential of nanomedicine, we should not forget

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about where we have come. (After all, the worldwide market for nanoscale devices was US\$406 million in 2002 [<http://www.bccresearch.com/editors/RB-162.html>]). Here, it is safe to say, that we have already met one important expectation: we have created products based on nanomedicine principles. Whether we will meet the continually increasing expectations of nanomedicine remains to be seen, but it is clear we have passed a significant milestone already that should put this question to rest.

## References

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