

Preface

This book is centered on a topic everybody is asking. What is the commercial potential of nanotechnology? Well, look no further than the integration of nanotechnology into medicine, the so-called area of research entitled “nanomedicine”. This book covers recent advances in the design, synthesis, and evaluation of nanomaterials to regenerate hard and soft tissues. Of course, when discussing how nanomaterials are being used to regenerate tissues, you cannot omit issues of toxicity. Thus, this book ends with several chapters concerning the current knowledge base of nanoparticle toxicity and how to evaluate nanoparticle toxicity.

So, then, 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 novel *Prey* in 2002), I bet you will be waiting a long time (if ever) to see commercial fruition. On the other hand, if you envision nanomedicine referring to listening to meditation music from your nanoIPOD (and, thus, healing your soul), then your in luck as you are already experiencing commercial benefits of nanotechnology.

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. This includes various nanomaterials (nanoparticles, nanotubes, nanostructured materials, and nanocomposites), nanotools (nanolithography tools and scanning probe microscopes), and nanodevices (nanosensors and nanoelectronics) which are available commercially, and for some, human use. While to some this may not

sound significant, consider for a moment the time span numerous government agencies around the world require to approve new medical devices 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 U.S. National Science Foundation (as one example) has contributed to this hype. The U.S. National Science Foundation is on record predicting that the market for nanotechnology, or products containing nanotechnology, will reach \$1 trillion in 10 to 15 years.¹ Clearly, medical products will be a significant part of this expectation. While 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, the excitement is still as high (if not more) than the first day that nanomedicine emerged over ten years ago.

The expected commercial potential has not decreased or even remained the same over the past decade; it 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.² Key nanomedicine technology platforms (such as nanocrystals, nanotubes, dendrimers, fullerenes, quantum dots and molecular scaffolding) are expected to drive that market expansion.² 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 real commercial potential of nanomedicine, we should not forget about where we have come. (After all, the worldwide market for nanoscale devices was 406 million dollars in 2002.³) 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 continual 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. Such milestones and prospects for the future are emphasized in the following pages of this first-of-a-kind book. Enjoy.

References

1. <http://www.biz-lib.com>, accessed, January 4, 2007.
2. <http://www.piribo.com>, accessed, January 4, 2007.
3. <http://www.bccresearch.com/editors/RB-162.html>, accessed, January 4, 2007.

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