nature materials Vol 2 No 3 March 2003 www.nature.com/naturematerials

Nanotechnology: Don't forget the big picture

It is now three years since Bill Clinton announced the National Nanotechnology Initiative. Not since John F. Kennedy's announcement of the US government's intentions to put a man on the moon has a scientific discipline so captured the imaginations of politicians, venture capitalists and pulp-fiction writers alike. But at the dawn of a so-called new era for science and technology, is there a danger that we could be letting our imaginations run away with us?

Some pundits dream of a future free from disease, in which the human body is continuously repaired by legions of medical nanobots, or super materials that neither break nor corrode, and manufacturing technologies in which everything from televisions to hamburgers is constructed atom by atom with zero waste and optimal energy efficiency. It seems that about the only thing that nanotechnology won't deliver is the eradication of taxes. To anyone with even a modicum of scientific training, such claims are obviously hype. As Nobel laureate Richard E. Smalley has pointed out[1], the world of the nanometre is not simply a scaled-down version of the macroscopic world. And as the commentary on page 129 suggests, many of the advances made under the banner of nanotechnology are more likely to highlight fundamental technological limits imposed by the physical world than help us to transcend them.

Cynics argue that the nanotech craze is simply a marketing strategy by researchers to attract more government research grants and venture capital. Yet, the potential of nanoscale research both for extending our understanding of the natural world and for the development of new technologies is undeniable. Moreover, any government initiative that seeks to channel new funds into basic research should be welcomed with open arms. The question is one of priorities.

The US government's National Nanotechnology Initiative is forecast to channel US$710.2 million into nanoscale science, engineering and technology in the fiscal year of 2003[2]. In comparison, the 2003 budget for renewable energy research is just US$407.72 million[3]. At a time of growing conflict in the Middle East, a situation that is exacerbated by the world's dependence on oil, it is fair to ask if we have the balance right.

THE WHEELS OF INNOVATION ARE MORE LIKELY TO BE DRIVEN BY MULTIDISCIPLINARY PARTNERSHIPS THAN BY THINKING SMALL.

It is true that nanotechnology may indeed help the world overcome its reliance on oil, through the development of more efficient energy generation and storage systems, or the discovery of new lightweight nanocomposite materials. It is also true that it is most likely to do so as an enabling technology within more conventional fields of research, than in its own right. It could therefore be argued that governments should focus more on broad objectives, and allow scientists to decide on what scales these might be achieved, instead of frantically searching for all possible ways in which the word 'nano' might be worked into their grant applications.

VOLKER STEGER / SANDIA NATIONAL LABORATORY / SCIENCE PHOTO LIBRARY

Beyond the hype, it is not the discovery of uncharted territory or the changing of paradigms that is likely to be nanotech's greatest strength. It is that the nanotech bandwagon encourages physicists, biologists, chemists, engineers and medical researchers to attend the same meetings, work in the same centres of innovation, and become involved in a broader marketplace of ideas. Through partnerships formed under the banner of nanotechnology, researchers can discover new angles and new approaches, and bring new life to old disciplines. Solutions to problems that have been found in one discipline do not have to be reinvented in another. So long as such multidisciplinary partnerships see beyond the current craze and remain open to thinking big as well as small, then nanotech's legacy will be great indeed.

1. Smalley, R. E. Of Chemistry, love and nanobots. *Scientific American* **285**, 76–77 (2001).
2. Roco, M. C. National nanotechnology investment in the FY 2003. http://www.nano.gov/2003budget.html
3. Department of energy FY 2003 congressional budget request. http://www.mbe.doe.gov/budget/03budget/