The Big Picture

While most of us are peering into and probing the nanoscale worlds that we design, create, and assemble, the long-term fate and impact of such structures remains relatively unknown. These big-picture views of nanostructures and their interactions with the surrounding world will be critical if we are going to scale up production to make nanostructures and nanosystems as ubiquitous as many of us anticipate. Two opinion pieces in this issue discuss aspects of this topic.[1−3]

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In their Perspective, Nel and co-workers discuss the development of high-throughput testing to enable rapid screening and predictive models of toxicological interactions of nanomaterials.[1] As they and others have pointed out, the variations and dispersities of nanomaterials preparations,[1,4−6] as well as the explosive growth in the diversity of the nanomaterials prepared, make conventional toxicological testing prohibitive and limited in value based on our inability to characterize comprehensively the materials being tested. Thus, high-throughput methods have at least three advantages: (1) speed and efficiency; (2) direction for and selection of further toxicological studies; and (3) guidance for syntheses, preparations, and assembly methods. While further detailed studies will nonetheless be required, these can be targeted and focused at key materials and doses, so that more information can be elucidated, including specific biological/toxicological interactions. Likewise, with early feedback, preparation methods can be altered so as to eliminate potentially harmful products and side products.[1,2,4]

IMAGE COURTESY OF NASA VISIBLE EARTH

Composite satellite image of the earth (http://visibleearth.nasa.gov/).

This last point was part of the discussion in the Nano Focus article by Alvarez *et al.*, describing the highlights of a workshop of the International Consortium on Nanotechonology held at Rice University on the fate, transport, and roles of manufactured nanomaterials in the environment.[2] They also suggest that one of the keys to managing the great diversity of materials will be to develop and to test predictive models. These models must find a way to bridge all the way from the molecular scale, to the biological and organism scales, to the environmental scale—quite a challenge!

Expect to see more scientific papers and perspective pieces from us on this fascinating topic, the big picture in nanoscience. As Nel, Alvarez, and their co-authors suggest, we hope that these ideas will help guide both the discussion and the work in this area, so that we can safely bring nanomaterials and assemblies to bear on the problems the world faces.

Finally, our congratulations go out to frequent contributor and the subject of our June Conversation,[6−8] Chad Mirkin, on being awarded the Lemelson-MIT Prize for invention for his work on nanoparticle-based diagnostics and dip-pen nanolithography,[9] and for seeing the big picture in our little worlds.

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Published online July 28, 2009.
10.1021/nn900718f CCC: $40.75

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