

# Strategic research plan needed to help avoid potential risks of nanomaterials

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Despite extensive investment in nanotechnology and increasing commercialization over the last decade, insufficient understanding remains about the environmental, health, and safety aspects of nanomaterials. Without a coordinated research plan to help guide efforts to manage and avoid potential risks, the future of safe and sustainable nanotechnology is uncertain, says a new report from the National Research Council. The report presents a strategic approach for developing research and a scientific infrastructure needed to address potential health and environmental risks of nanomaterials. Its effective implementation would require sufficient management and budgetary authority to direct research across federal agencies.

Nanoscale engineering manipulates materials at the molecular level to create structures with unique and useful properties -- materials that are both very strong and very light, for example. Many of the products containing nanomaterials on the market now are for skin care and cosmetics, but nanomaterials are also increasingly being used in products ranging from medical therapies to food additives to electronics. In 2009, developers generated \$1 billion from the sale of nanomaterials, and the market for products that rely on these materials is expected to grow to \$3 trillion by 2015.

The committee that wrote the report found that over the last seven years there has been considerable effort internationally to identify research needs for the development and safe use of nanotechnology, including those of the National Nanotechnology Initiative (NNI), which

coordinates U.S. federal investments in nanoscale research and development. However, there has not been sufficient linkage between research and [research findings](#) and the creation of strategies to prevent and manage any risks. For instance, little progress has been made on the effects of ingested nanomaterials on [human health](#) and other potential health and environmental effects of complex nanomaterials that are expected to enter the market over the next decade. Therefore, there is the need for a research strategy that is independent of any one stakeholder group, has human and environmental health as its primary focus, builds on past efforts, and is flexible in anticipating and adjusting to emerging challenges, the committee said.

Because the number of products containing nanoscale materials is expected to explode, and future exposure scenarios may not resemble those of today, selecting target materials to study on the basis of existing market size -- as is the practice now -- is problematic. To help guide research, the committee noted the following four research categories, which should be addressed within five years:

- identify and quantify the nanomaterials being released and the populations and environments being exposed;
- understand processes that affect both potential hazards and exposure;
- examine nanomaterial interactions in complex systems ranging from subcellular to ecosystems; and
- support an adaptive research and knowledge infrastructure for accelerating progress and providing rapid feedback to advance research.

While surveying the existing resources for research, the committee acknowledged a gap between funding and the level of activity required to support the committee's strategy. The committee concluded that any

reduction in the current funding level of approximately \$120 million per year over the next five years for health and environmental risk research by federal agencies would be a setback to nanomaterials risk research. Moreover, additional modest resources from public, private, and international initiatives are needed in critical areas -- informatics, nanomaterial characterization, benchmarking [nanomaterials](#), characterization of sources, and development of networks for supporting collaborative research -- to derive maximum strategic value from the research investments.

Implementation of the strategy should also include the integration of domestic and international participants involved in nanotechnology-related research, including the NNI, federal agencies, the private sector, non-governmental organizations, and the academic community. The committee said that the current structure of the NNI -- which has only coordinating functions across federal agencies and no top-down budgetary or management authority to direct nanotechnology-related environmental, health, and safety research -- hinders its accountability for effective implementation. In addition, there is concern that dual and potentially conflicting roles of the NNI, such as developing and promoting nanotechnology while identifying and mitigating risks that arise from its use, impede application and evaluation of health and environmental risk research. To carry out the research strategy effectively, a clear separation of management and budgetary authority and accountability between promoting nanotechnology and assessing potential environmental and safety risks is essential.

Provided by National Academy of Sciences

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