

Nanotechnology

What is Nanotechnology?

Nanotechnology, often claimed to be the next industrial revolution, is defined by the Project on Emerging Nanotechnologies (PEN) as, "the art and science of manipulating matter at the nanoscale to create new and unique materials and products." This means working with materials that have at least one dimension measuring between 1-100 nanometers.

A nanometer is one-billionth of a meter. To put this in perspective, a sheet of paper is approximately 100,000 nanometers thick and a DNA strand has a diameter of 2 nanometers. Properties emerge at the nanoscale which are not found in other scales (i.e. nano-silver has properties which differ from bulk silver).

These unique properties are driving nanotechnology research and development. Possibilities for nanotechnology range from stain-resistant clothing to improved cancer detection and treatment to breakthroughs in energy storage. However, with these potential rewards come potential risks which must be anticipated and addressed.

Where is Nanotechnology?

Although nanotechnology sounds like something confined to laboratories, PEN reports that it can already be found in over 1,000 consumer products. The main subcategories of products are personal care items, clothing, and cosmetics, meaning our exposure to nanotechnology is often very intimate.

The most common nanomaterial utilized for consumer products is nanosilver. Nanosilver has powerful anti-microbial properties, which is why it is frequently utilized as a coating on consumer products. For example, Sharper Image sells socks which are infused with nanosilver in order to prevent bacterial build-up.

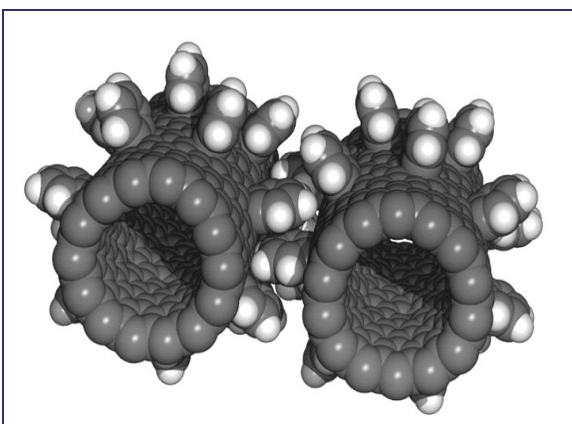
Other examples of consumer products include sunscreens that are more transparent because of nanoparticles and air filters which utilize nanotechnology to capture more particles.

Why are we concerned about Nanotechnology?

Although nanotechnology is increasingly becoming a part of our lives, the impact it will have on human health and the environment is largely unknown. The following examples show, however, that there is reason to be concerned.

A recent study determined that nanosilver, when released into waterways, can mutate or destroy fish embryos. It has also been shown that carbon nanotubes, when inhaled, look and behave like asbestos fibers, a material known to cause cancer. In China, after unprotected exposure to nanomaterials in a factory, two women died and five women became severely ill because of lung damage.

These are some of the known risks, but more disturbing is the unknown. Every day nanomaterials are manufactured, transported, consumed, and disposed with little knowledge on the short or long-term impacts. Until the risks are known, we should use a precautionary approach to protect human health and the environment.



Nanogears developed by NASA

What is being done to protect us?

Despite the risks and uncertainty, nanotechnology is almost completely unregulated. In the United States, only the city of Berkeley, CA and the state of California have enacted mandatory regulations regarding nanotechnology.

The only regulation occurring at the federal level by the EPA is the required registration of products which claim to kill germs or bacteria, such as many nano-silver products, because these qualify as pesticides. Otherwise, nanotechnology can be used in products without the government or consumers being aware of it. No federal standards have been established regarding safe exposure to nanotechnology.

In the 2009 budget for the National Nanotechnology Initiative (NNI), the national agency coordinating nanotechnology R&D, only about 5% was dedicated to environmental health and safety research. Clearly, our health and safety are not a priority.

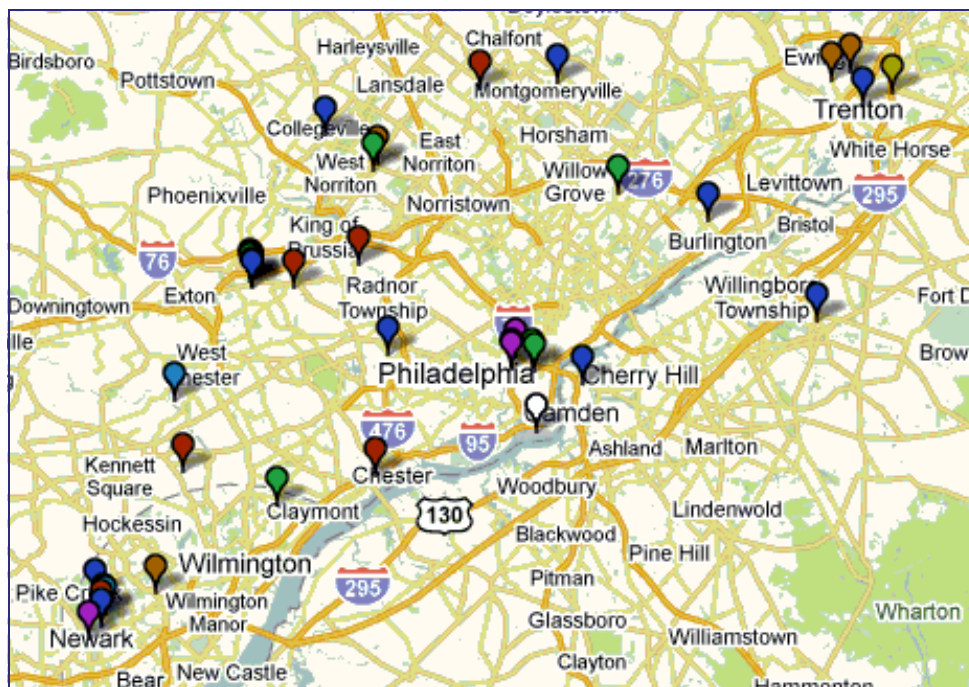
What should be done to protect us?

Berkeley, CA has set a great precedent by requiring the reporting of nanomaterials and any known risks. Until we have more data on risks, we must collect and make available information on the presence of nanomaterials so that we are prepared in the case of an emergency. The state of California has begun more limited mandatory reporting and the Wisconsin legislature is also considering creating a registry.

Beyond reporting, we need to fill the knowledge gaps. We need to know more about the risks of nanotechnology before potential problems are too widespread to be contained. To do this, there needs to be more funding committed to environmental health and safety research - at least 10% of the NNI budget.

Finally, significant regulatory overhaul will be required to adequately address nanotechnology. Agencies at all levels must begin this process.

A Map of Nanotechnology R&D in the Philadelphia Area.



Courtesy of the Project on Emerging Nanotechnologies, available at <http://www.nanotechproject.org/inventories/map/>

Action Required!

Nanotechnology holds great promise for humanity. Working on this scale, we can tackle problems that once seemed unsolvable. However, history has shown that technologies with great promise often bring great peril. We must anticipate these risks in order to maximize the benefits. A great start to the responsible development of nanotechnology would be mandatory reporting requirements followed by appropriate regulations as risks become more apparent.

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