

Adventium Challenge 2006

Version 24 September, 2006

“Nanotechnology” is a very broad term referring to any of a host of applications involving nano-scale artifacts. To quote from the Foresight Nanotech Institute's FAQ:

“The definition most frequently used by government and industry involves structures, devices, and systems having novel properties and functions due to the arrangement of their atoms on the 1 to 100 nanometer scale.

Many fields of endeavor contribute to nanotechnology, including molecular physics, materials science, chemistry, biology, computer science, electrical engineering, and mechanical engineering.

Due to the extreme breadth and generality of this definition, many prefer to use the term "nanotechnologies." For clarity, it is also useful to differentiate between near-term and long-term prospects, or to segment the field into first-generation through fourth-generation stages.”

Foresight's website also provides a good starting place to explore both potential nano-scale technologies (e.g, nano motors, self-assembling/self-replicating structures, nano-scale composite materials, smart matter, and others) and manufacturing methods. See, for example, <http://www.foresight.org/nano/technical.html>.

Research objective:

Your task is to choose one of the Foresight Nanotechnology Challenges <http://www.foresight.org/challenges/index.html> and to propose a nanotechnology solution to some aspect of that challenge. You must select from one of the following three challenges:

1. Providing Renewable Clean Energy
2. Supplying Clean Water Globally
3. Improving Health and Longevity

As part of this project, you should address technical, environmental, financial, and social issues that will affect the difficulty or likelihood of your solution being successful, as well as the potential technical, environmental, and social impacts of either success or failure.

Details of the research task:

1. Select one of the 3 broad challenges at <http://www.foresight.org/challenges/index.html> as the basis for your research. You must select from one of the following three challenges:
 - Providing Renewable Clean Energy
 - Supplying Clean Water Globally
 - Improving Health and Longevity

2. Develop a nanotech-based solution to some aspect of the broad challenge that your team has selected.
3. Answer the following questions about your solution
 - a. Significance of the problem being addressed: Why is it important to solve? Who will be affected and how?
 - b. Technical approach: How does your approach solve the problem? How will you know if it works?
 - c. Technical relevance: What other solutions to the problem exist or are being explored, and why is your approach better? In particular, why is a nanotech solution the preferred approach?
 - d. Technical hurdles: Why hasn't your solution already been tried? What is hard about it? What are particular differences or characteristics of behavior matter at the scales you propose compared to the scale where we humans normally interact with chemistry and physics. (For example, we use grease on bearings. If your machine has moving parts, would the same grease work as well?)
 - e. Staff: How many people and what skills are required to do the development?
 - f. Economics: Who will pay for the initial investment? Why? What will the setup cost? What will it cost once it is in production? How long will it take to get the first one working? Who will pay for the final product? Who will pay for disposal and cleanup?
 - g. Environment: What raw materials are needed for production? What waste materials are produced? How are your products disposed of at the end of their lifecycle? Who will be able to use the first products? Who decides? What happens if the product is released into the environment (e.g., atmosphere and inhaled, waterways, agriculture, airplane or other fine machinery)? What laws and regulations apply to your solution?
 - h. Risks: What could go wrong? Consider the term "gray goo" as one example of a worst-case scenario.
4. Present research findings in the following format
 - a. Written document in MS Word or PDF to be delivered to the judges 1 week before the competition. This document should be no more than 16 pages in length and include a complete bibliography of sources. There will be a penalty of 25% of the Research and Presentation score if this deadline is not met.
 - b. Poster session for the competition (2' x 3' poster). The poster information should include:
 - i. The selected grand challenge
 - ii. The technical approach
 - iii. Summary of the research
 - iv. Description of the team and assignments

In addition to the poster you will be expected to give a presentation no longer than five minutes designed to remind judges of your report and highlight the importance of your problem and the quality of your technical approach. This presentation is just a presentation, not a "skit". You will then be expected to answer detailed questions about your report and enter a discussion with the judges about your conclusions. The poster should be

displayed in your pit area when you are not being judged, so others may look at it and discuss it with you..

5. Resources:

- <http://www.nano.gov/>
- <http://www.foresight.org/>
- "Nanosystems: Molecular Machinery, Manufacturing, and Computation," K. Eric Drexler, 1992.

Award for the top presentation and report:

Adventium Labs will work with the winning team to identify opportunities for the team to move the proposed research to reality