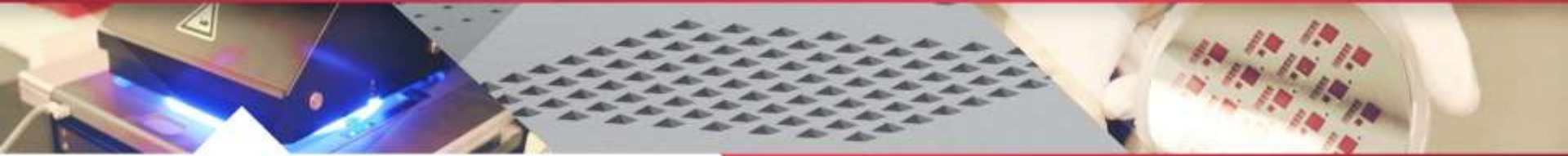




MINNESOTA NANOCENTER



Careers in Nanotechnology

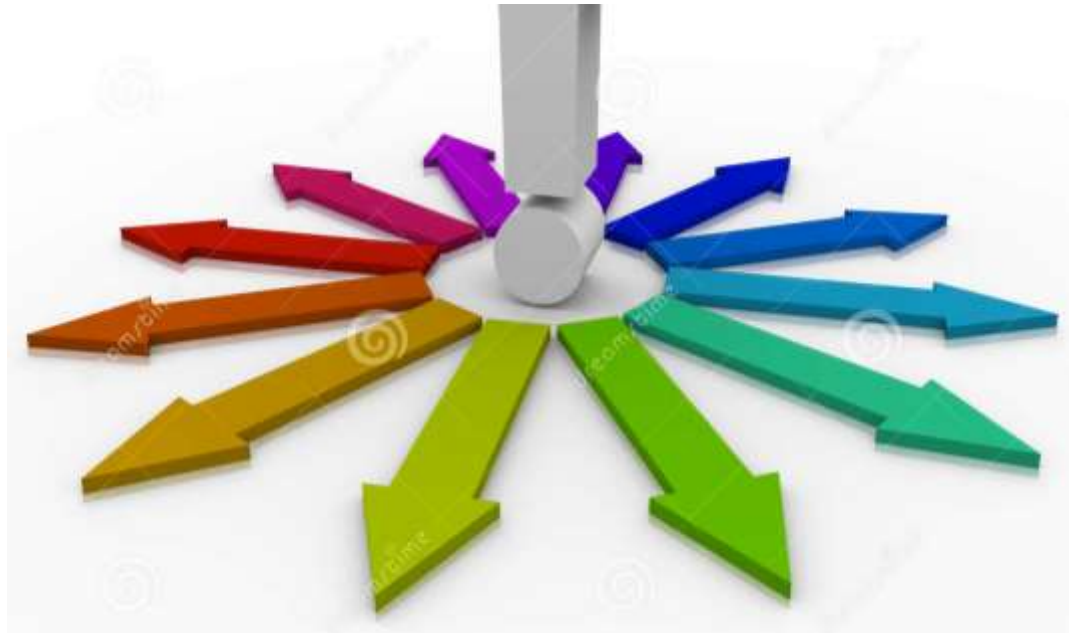
Opportunities for STEM Students

James Marti, Ph.D.

Minnesota Nano Center, University of Minnesota

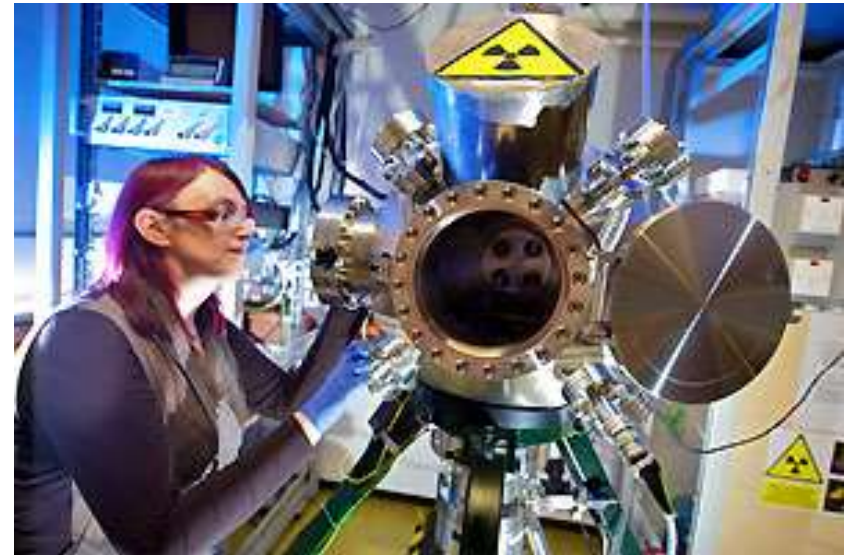
Can Your Students Find a Nanotechnology Career?

There are many paths to a career in nanoscience and engineering.



Nanotechnology Careers

Engineer: developing new materials and devices that operate at the nanoscale



Scientist: researching new nanoscale materials, devices, and phenomena

Nanotechnology Careers

Technician: applying nano knowledge to lab operations, QC, material analysis



End user: utilizes nano-enabled technologies to accomplish objectives (manufacturing, product development, environmental monitoring, ...)



Are There Nanotechnology Jobs?

- The number of STEM jobs **increased 20%** between 2000 and 2014
- 2010 estimate: 2 million new nanotechnology jobs will be needed by in US 2020 (*National Science Foundation*)
- There are currently an estimated 132,500 *nanotechnology engineers* in the United States. The nanotechnology engineer job market is expected to grow by 6.4% between 2016 and 2026 (*careerexplorer.com*)

Nanotech jobs ≠ “nanotechnology engineers”

Nanotech jobs are at many different levels with a range of job titles.

Nanotechnology Job Titles

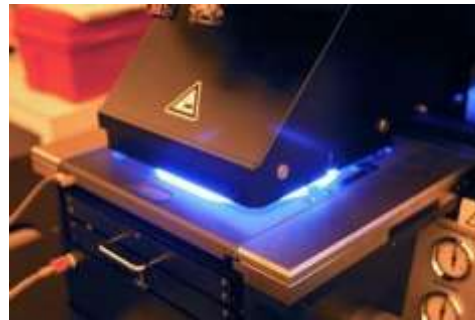
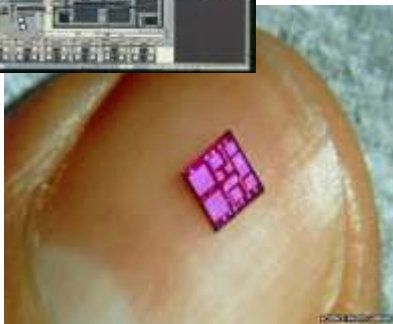
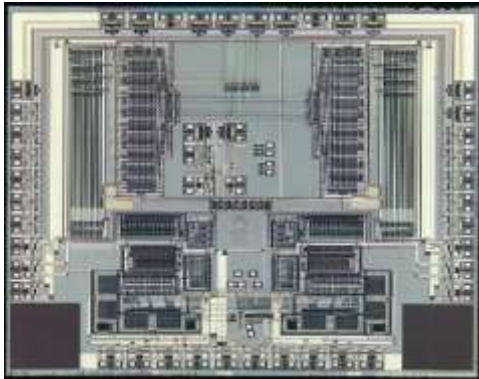
- Lab technician
- Quality control engineer
- Engineering support
- Research scientist
- Product developer
- Materials analyst
- Cleanroom tool operator
- R&D engineer
- Applications engineer
- Director of product development
- Director of research
- Holography technician
- Manufacturing engineer
- Lithography technician
- Mechanical engineer
- Microscopist
- Optical assembly technician
- Thin film scientist
- Product manager
- Etch technician
- Technical program manager
- IC packaging technician
- Filtration specialist
- Particle scientist

Where Would a Nanotechnologist Work?

Electronics manufacturers: Intel, AMD, Samsung, Seagate, Qualcomm, Hewlett-Packard

Tasks: fabrication of integrated circuit-based devices...

...using the tools of lithography



Where Would a Nanotechnologist Work?

Specialty materials companies: 3M, Dupont/Dow, Honeywell, HB Fuller, Corning, Cabot

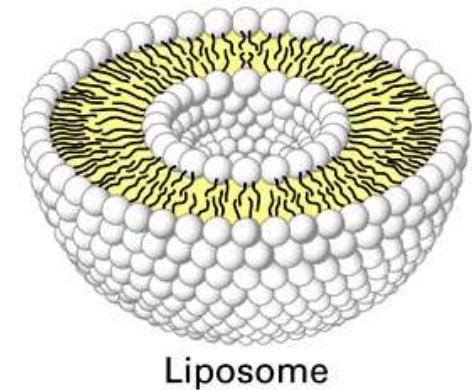
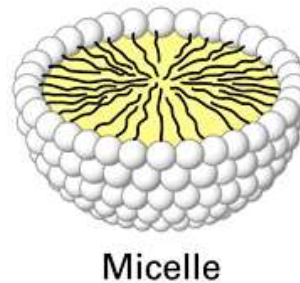
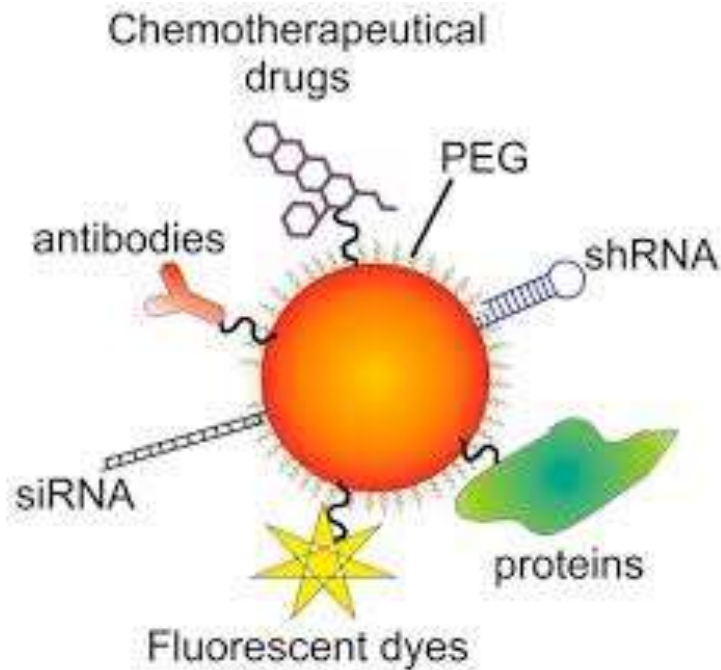
Tasks: Making and testing nanoparticles and nanostructured materials for paints, pigments, wear coatings, filtration, lubricants, sealants, security inks, displays, cosmetic/personal care products...



Where Would a Nanotechnologist Work?

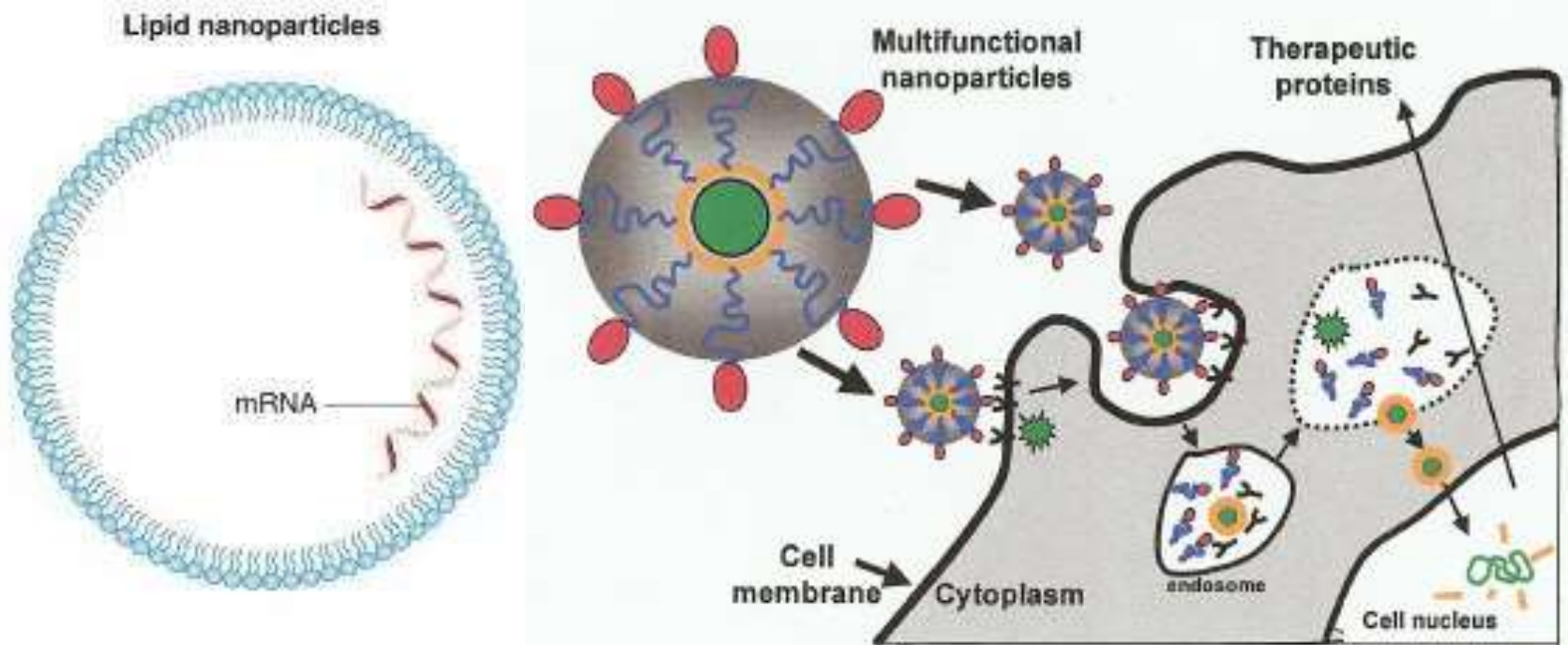
Pharmaceutical companies: Pfizer, Merck, Abbott, GSK

Tasks: Making and testing nanocapsules, liposomes, and other nanoparticles for controlled drug release and targeted delivery.



Nanotechnology and the COVID Vaccines

- COVID (and future) vaccines are based on mRNA
- These need nanoparticle lipid-based capsules to deliver to cells
- Current shortage of these nanocarriers delaying vaccine rollout



Where Would a Nanotechnologist Work?

Food processors: General Mills, Cargill

Tasks:

- developing, testing, optimizing small particles for food additives to add color, flavor, texture, nutrition
- making food products through spray drying, grinding, emulsions



Where Would a Nanotechnologist Work?

Analytical laboratories: many small to medium-sized companies

Tasks: Quantitative analysis of many products for chemical, physical, biological properties; forensic testing; safety and wear testing



Where Would a Nanotechnologist Work?

- Many employers are small companies and startups
- Large companies can support further education
- Universities and federal labs also hire graduates with nanotech background

Preparing for a Career in Nanotechnology

High school preparation

- Concentrate on science and math
- Chemistry, physics, and biology are all subjects that can prepare students for this field

Options after high school

- Technician: 2 year college degree (AA, AAS)
- Several programs around country for 2 year Associates in nanoscience technology
- Micro Nano Technology Education Center (MNT-EC)

Preparing for a career in Nanotechnology

Options after high school

- Nanoengineer: 4yr Bachelors degree and up
 - A few “Nanotechnology” programs
 - Most pursue traditional engineering disciplines: electrical, mechanical, chemical, biomedical engineering
- Nanoscientist: Masters or PhD degrees
 - Physics, chemistry, material science, biology
 - Engineering fields

For More Information

What is Nanotechnology?

www.nano.gov/nanotech-101/what

Nanotechnology Training Programs

The Micro Nano Technology Education Center,
ate.is/MNT-EC

Careers in Nanotechnology

www.nnci.net/careers-nanotechnology