

Applications of Nanotechnology

February 5, 2021



Welcome

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PennState

Welcome

Jared Ashcroft

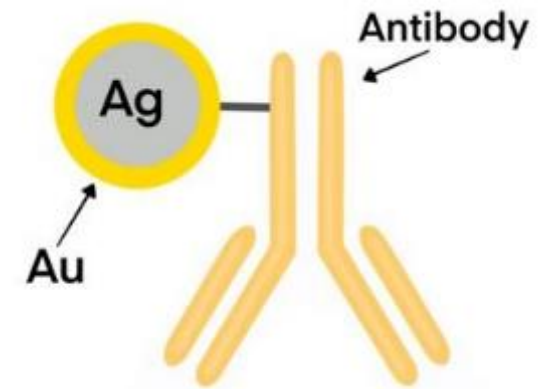
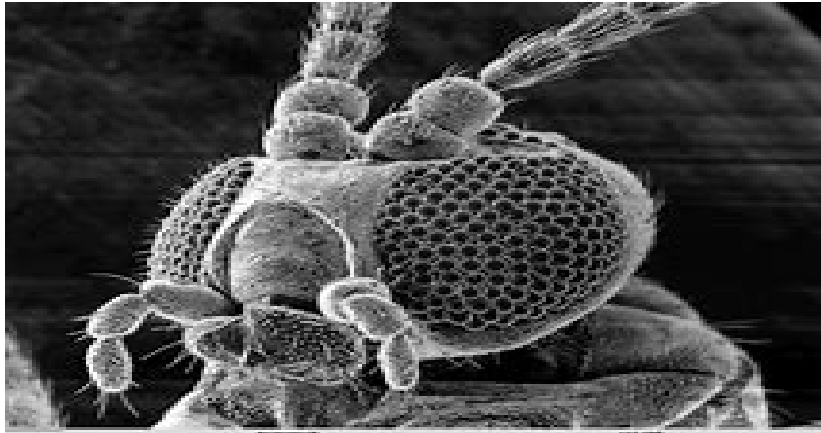
Faculty, Chemistry
 PI of the Micro Nano Technology
 Education Center (MNT-EC)
 Pasadena City College
 Pasadena, CA
jmashcroft@pasadena.edu



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Applications of Nanotechnology

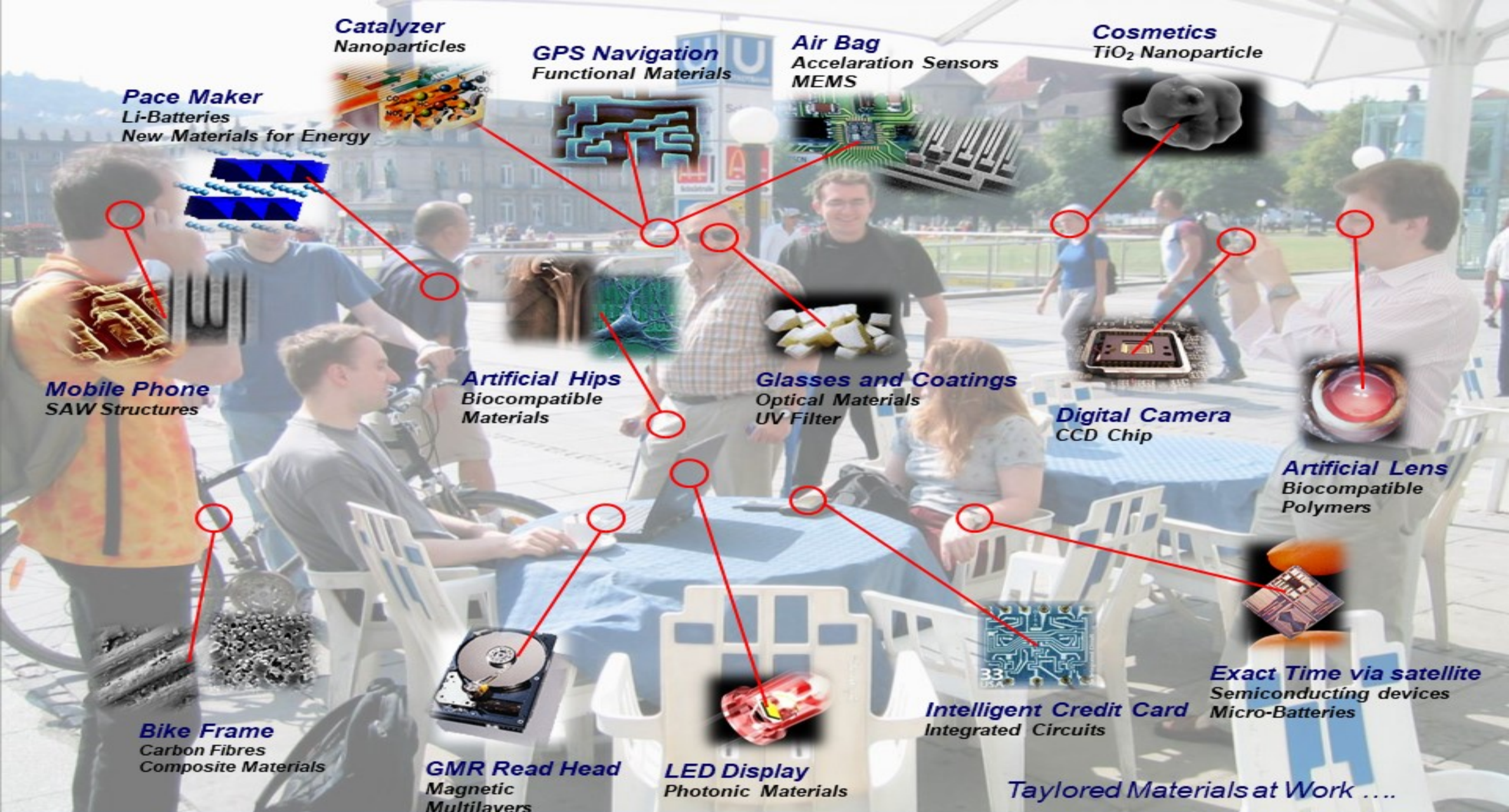
Nano is all around you!



On a typical day...

Anywhere in
the world....





Pace Maker
Li-Batteries
New Materials for Energy

Catalyzer
Nanoparticles

GPS Navigation
Functional Materials

Air Bag
Acceleration Sensors
MEMS

Cosmetics
TiO₂ Nanoparticle

Mobile Phone
SAW Structures

Artificial Hips
Biocompatible
Materials

Glasses and Coatings
Optical Materials
UV Filter

Digital Camera
CCD Chip

Artificial Lens
Biocompatible
Polymers

Bike Frame
Carbon Fibres
Composite Materials

GMR Read Head
Magnetic
Multilayers

LED Display
Photonic Materials

Intelligent Credit Card
Integrated Circuits

Exact Time via satellite
Semiconducting devices
Micro-Batteries

Taylorred Materials at Work

Application Areas for Nanotechnology

*Medicine
and
Health*

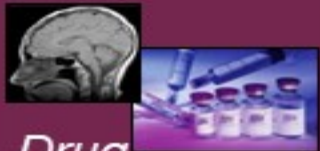
*Information
Technology*

*Energy
Production
/ Storage*

*Materials
Science*

*Food, Water
and the
Environment*

Instruments



*Drug
delivery*



*GMR Hard
Disk*



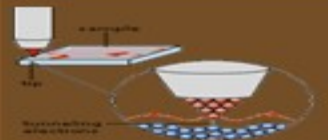
*Hydrogen
Fuel Cells*



*Lightweight &
strong matls.*



*Remediation
methods*



*Tunneling
microscopy*



*Treatments
for Cancer*



*Molecular
Switches*



Solar Cells



*City-Sized
Skyscrapers*



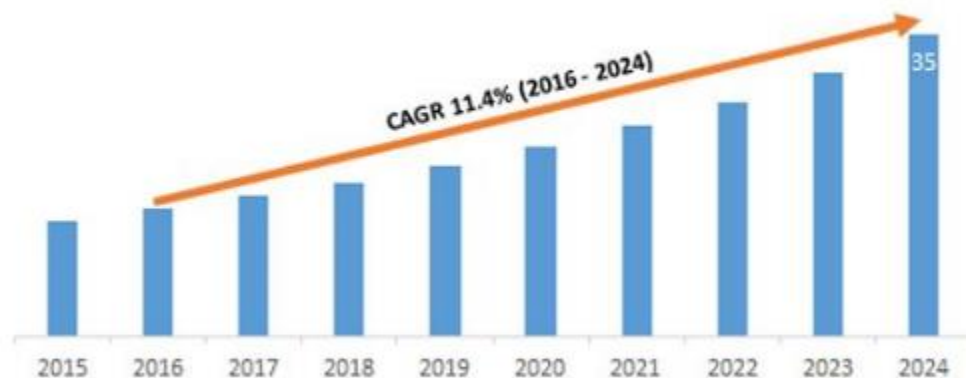
*"Smart"
Membranes*



*Nano
Manipulators*

Is impacting virtually all technological sectors as
an "enabling" or "key" technology

Global Microelectromechanical Systems (MEMS) Market Size and Forecast, 2015 - 2024 (US\$ Billion)

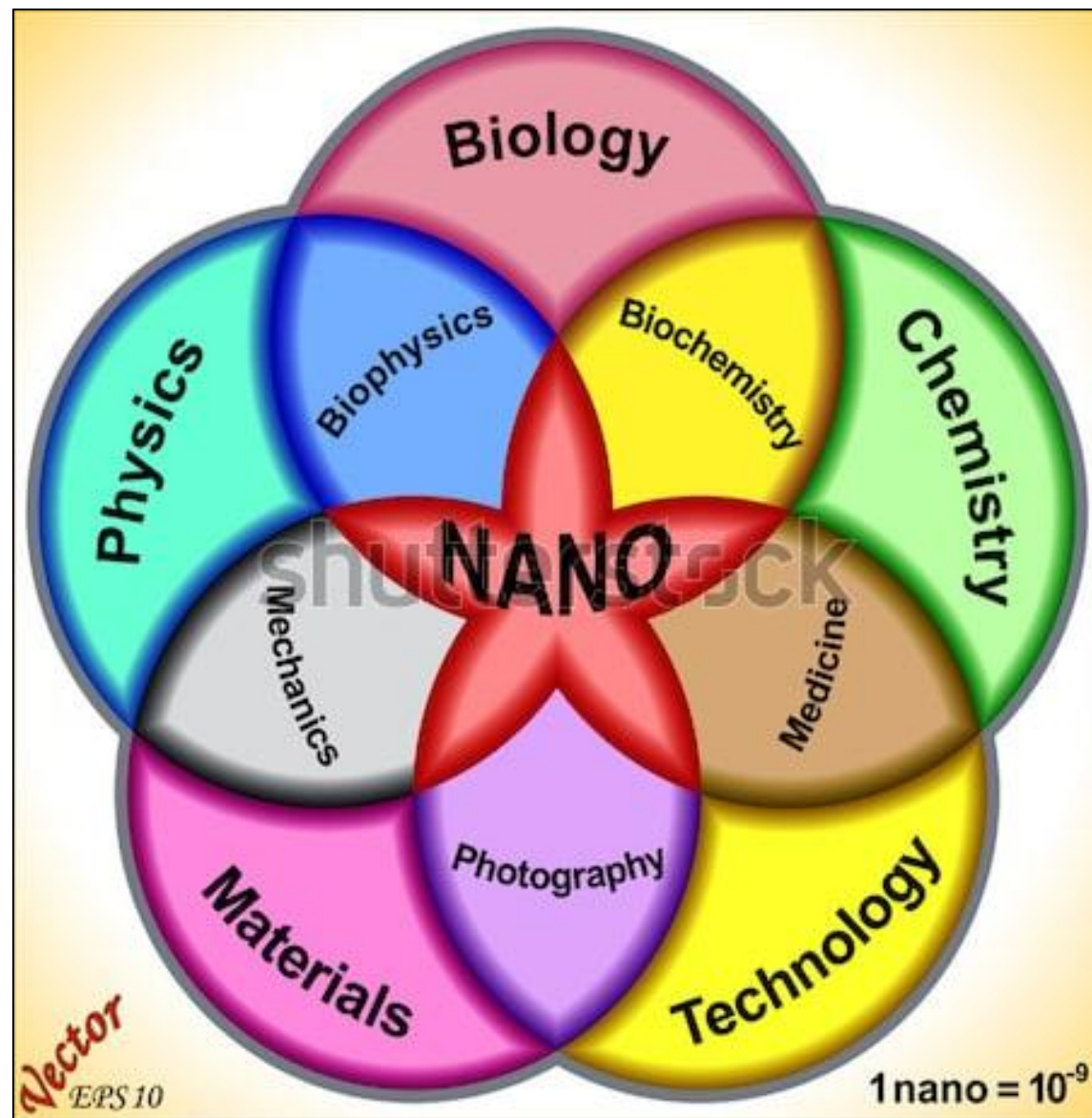


Source: Variant Market Research

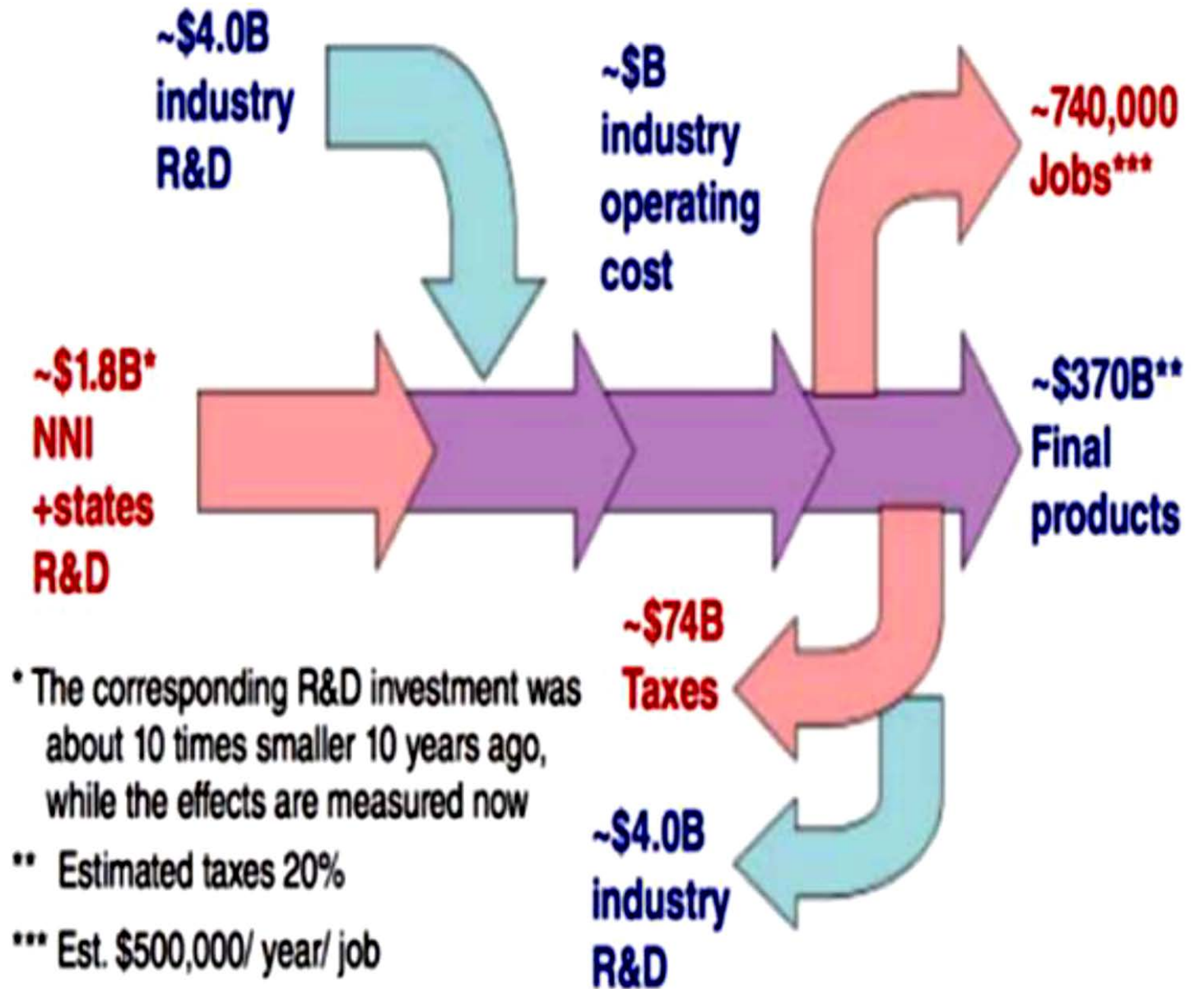
Global Nano Healthcare Technology for Medical Equipment Market



Source: Penisternice Market Research, 2017



Nanotechnology Economic Impact and Jobs Creation

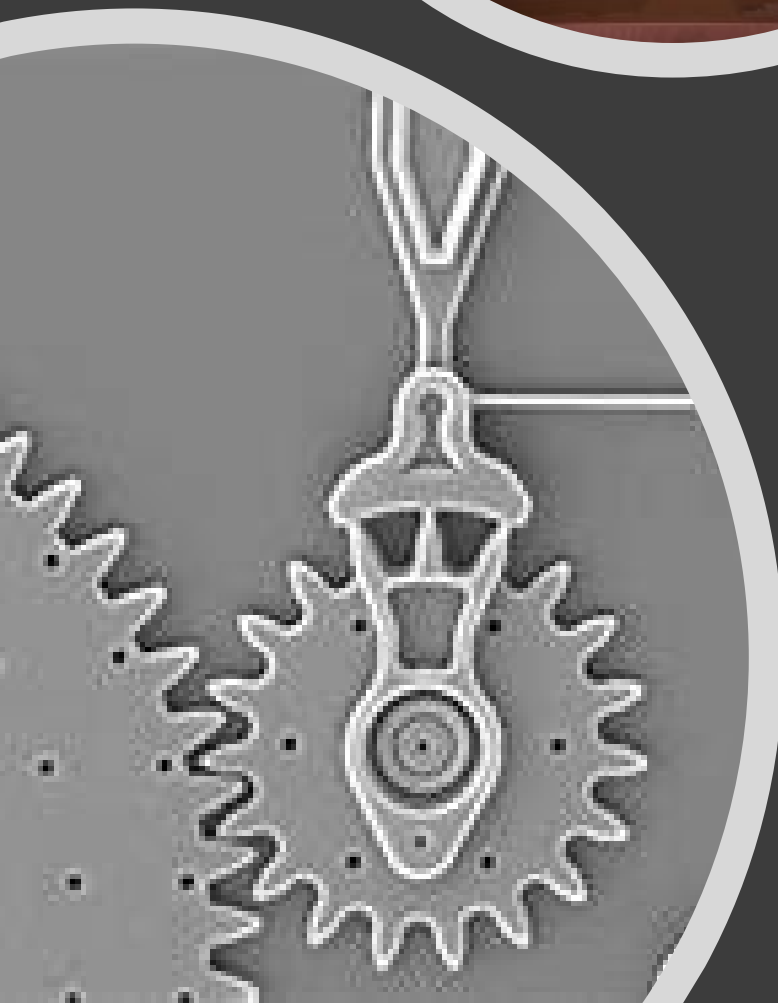
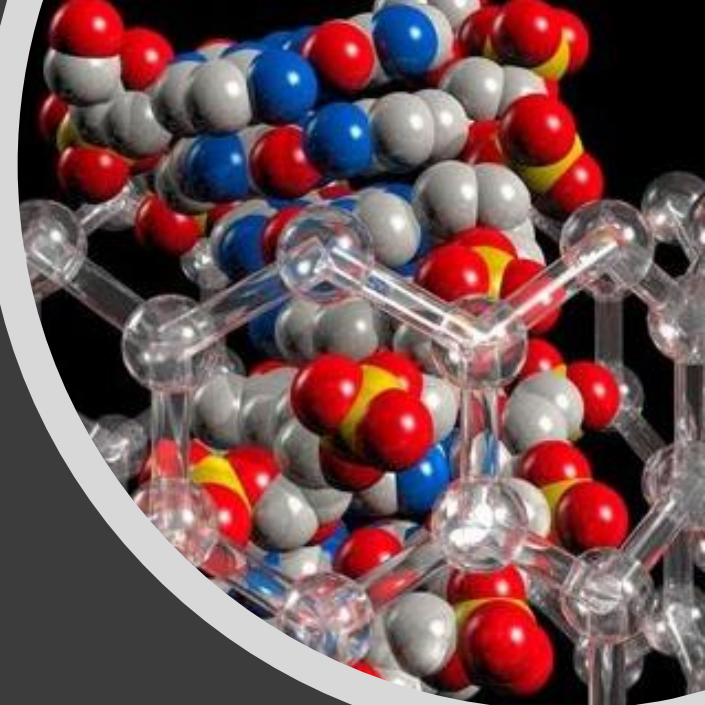
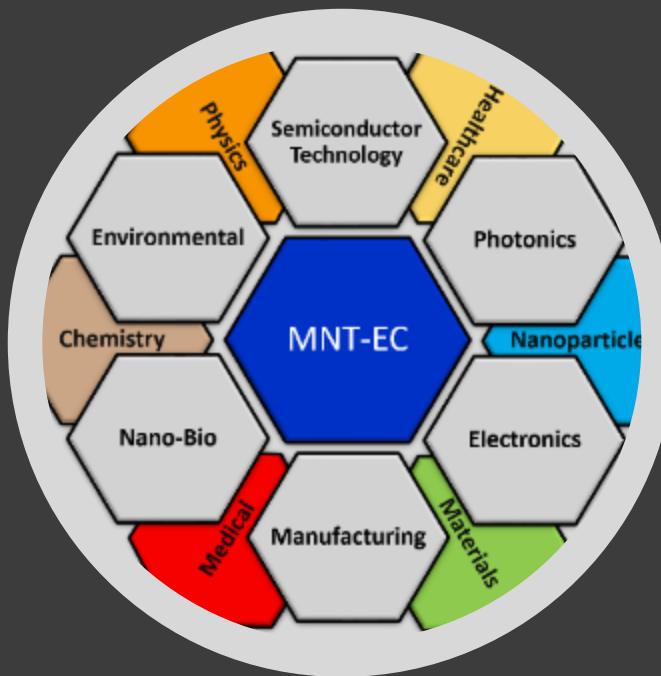
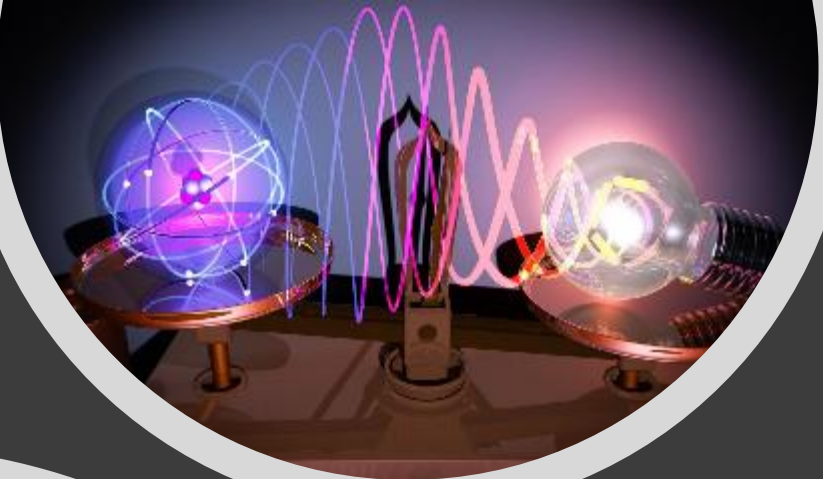


* The corresponding R&D investment was about 10 times smaller 10 years ago, while the effects are measured now

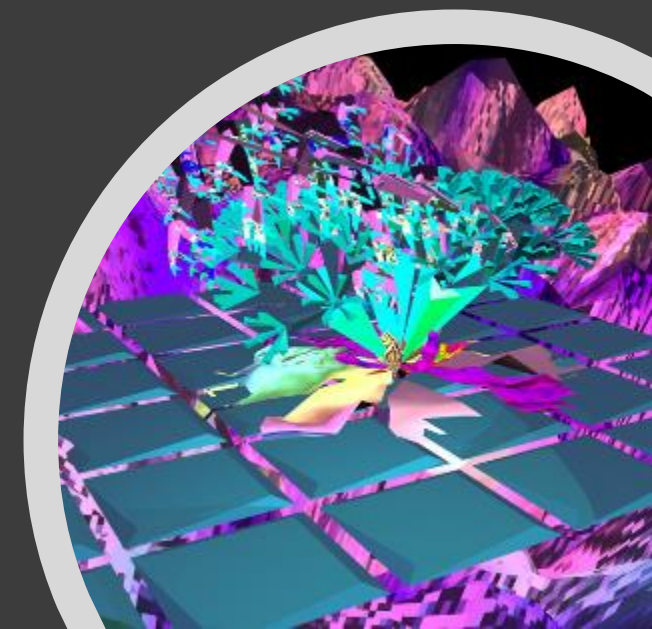
** Estimated taxes 20%

*** Est. \$500,000/ year/ job

Use NSF and Lux Research data



Build Bridges to Converging
MNT Industries, K-12,
Community College, and
Research Universities





This is not Nano! But
it is Fun?



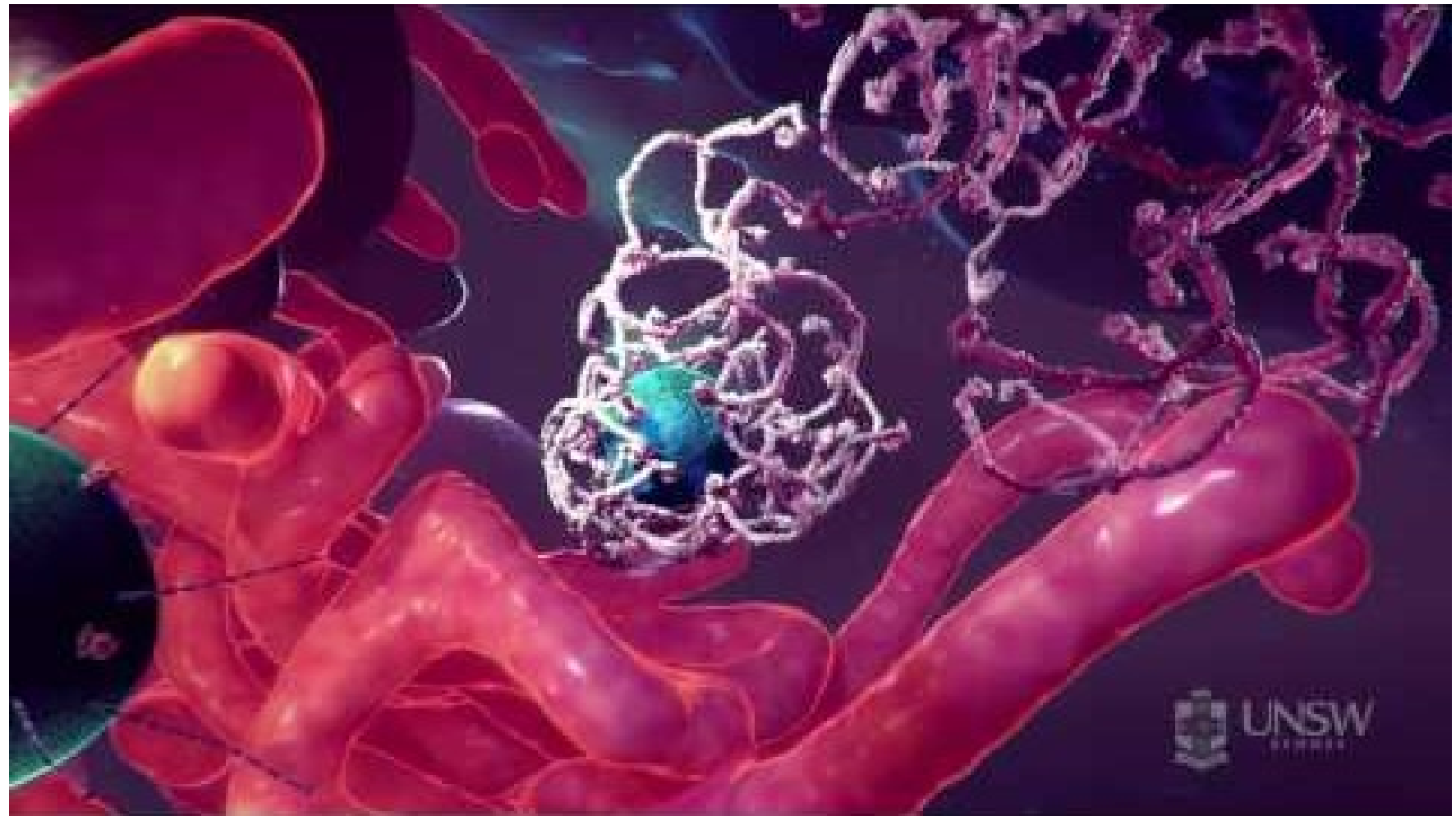


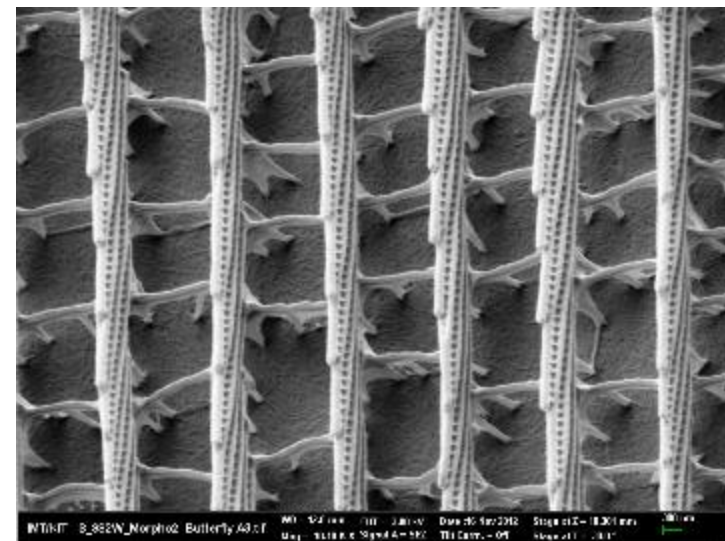
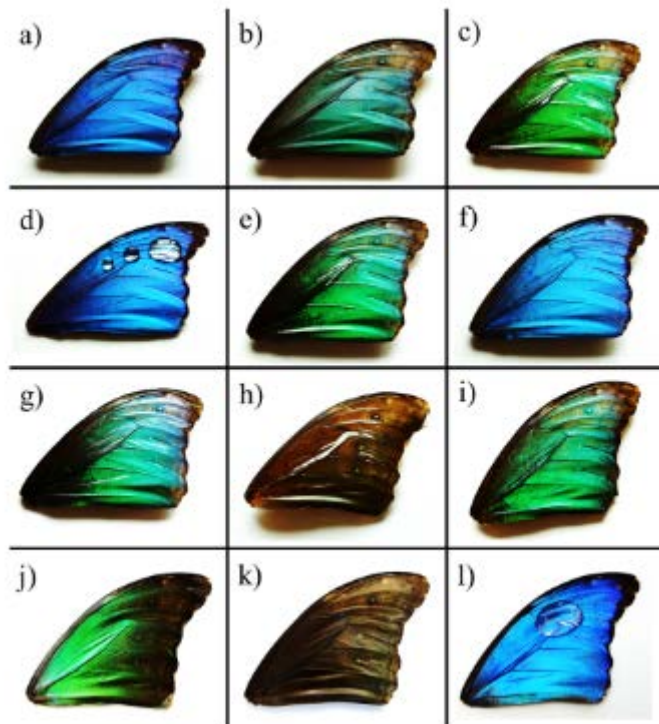
Nanomaterials are being developed at MIT to be used by the military

Nanotechnology in Biology

Living the best nano life!

Wouldn't
we rather
use nano
to save
lives?

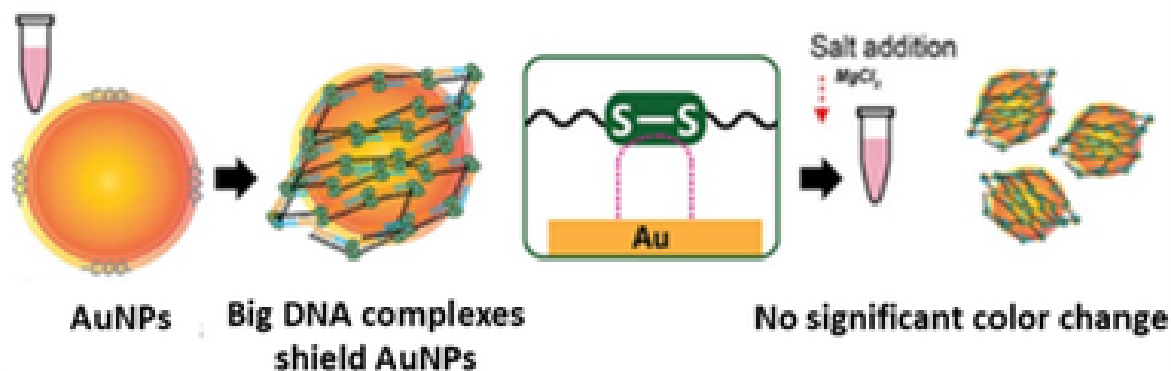




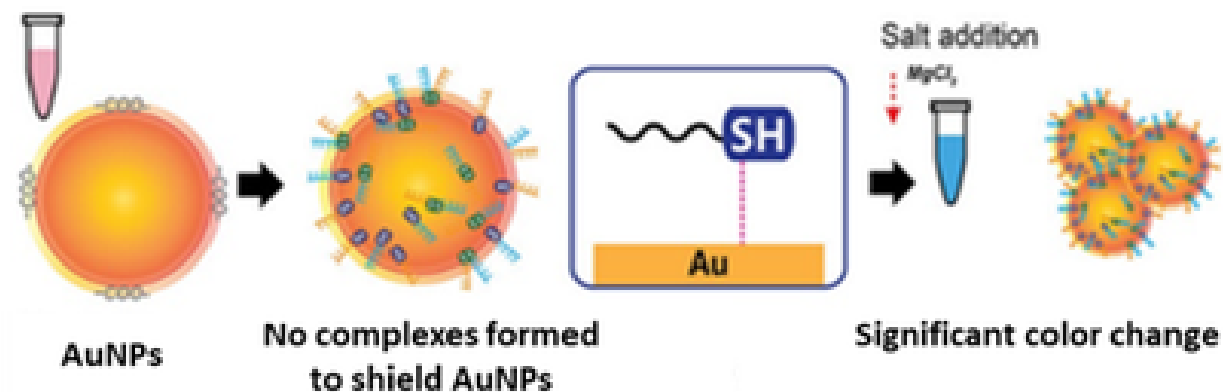
Nanobiology

Brittany A. Bober, Jennifer K. Ogata, Veronica E. Martinez, Janae J. Hallinan, Taylor A. Leach, and Bogdan Negru
Journal of Chemical Education **2018** 95 (6), 1004-1011
 DOI: 10.1021/acs.jchemed.7b00463

Probe matches targets



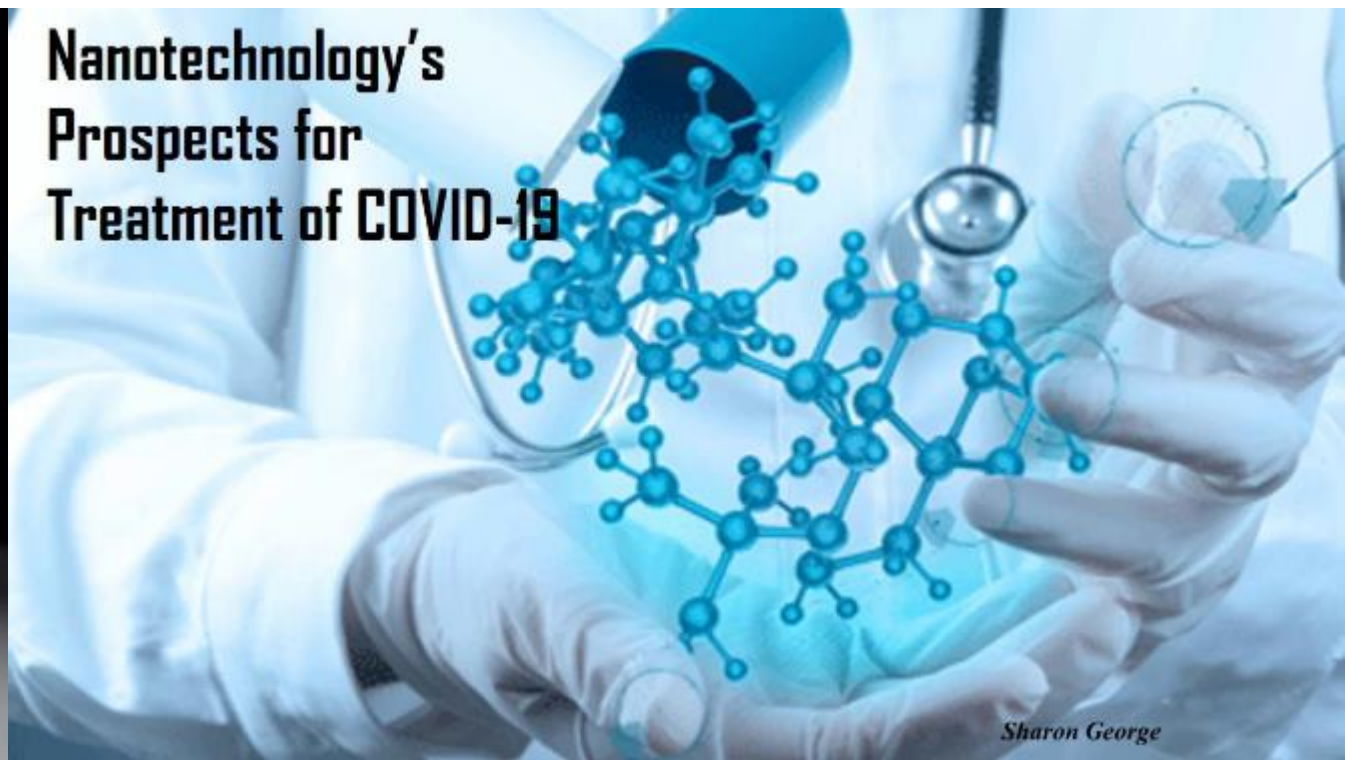
Probe without matching targets

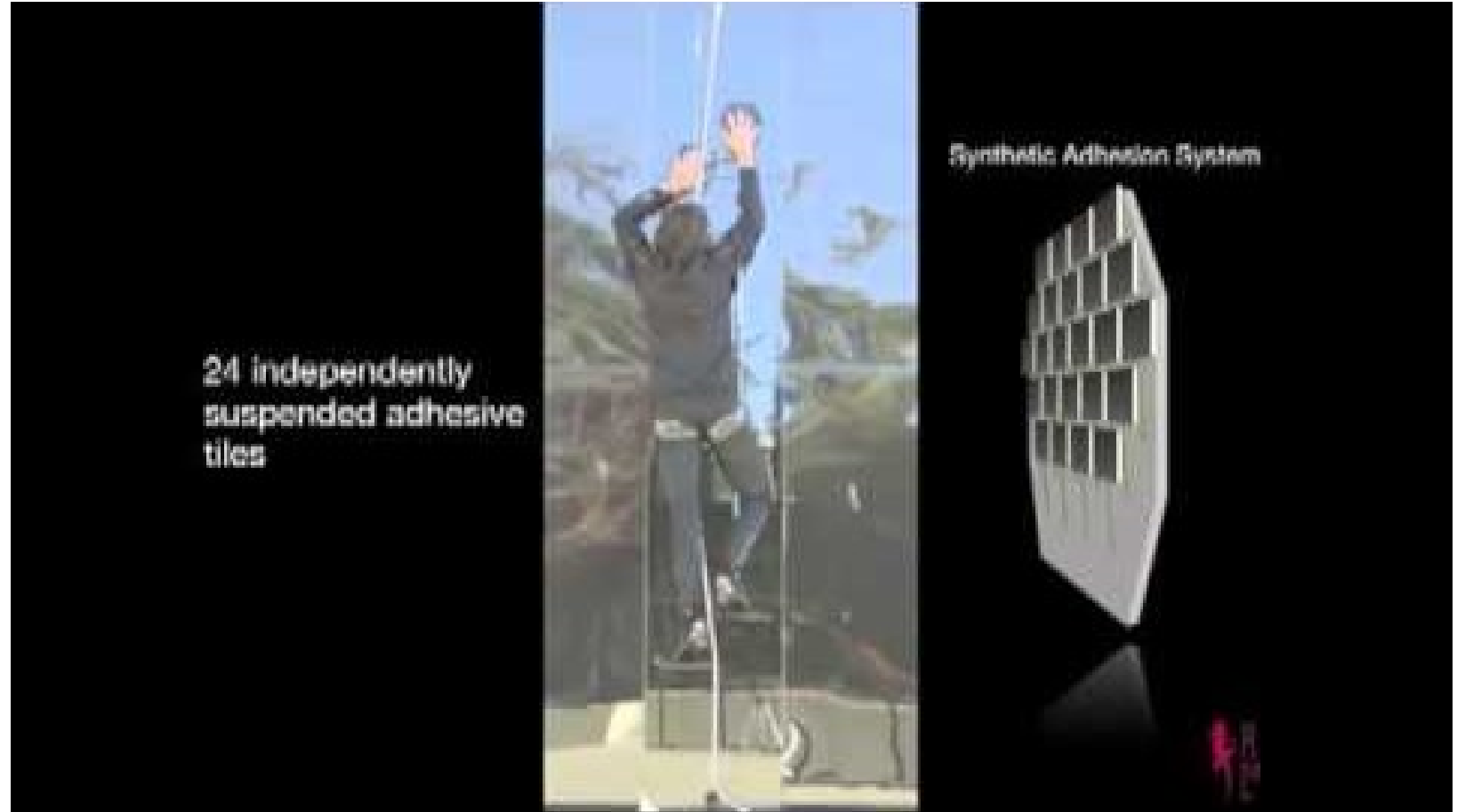


Covid-19 Vaccine Contains NANO-TECHNOLOGY

Covid-19 Vaccine Contains "Nano-Particles" says Australian Vaccine Researcher!

Nanotechnology's Prospects for Treatment of COVID-19



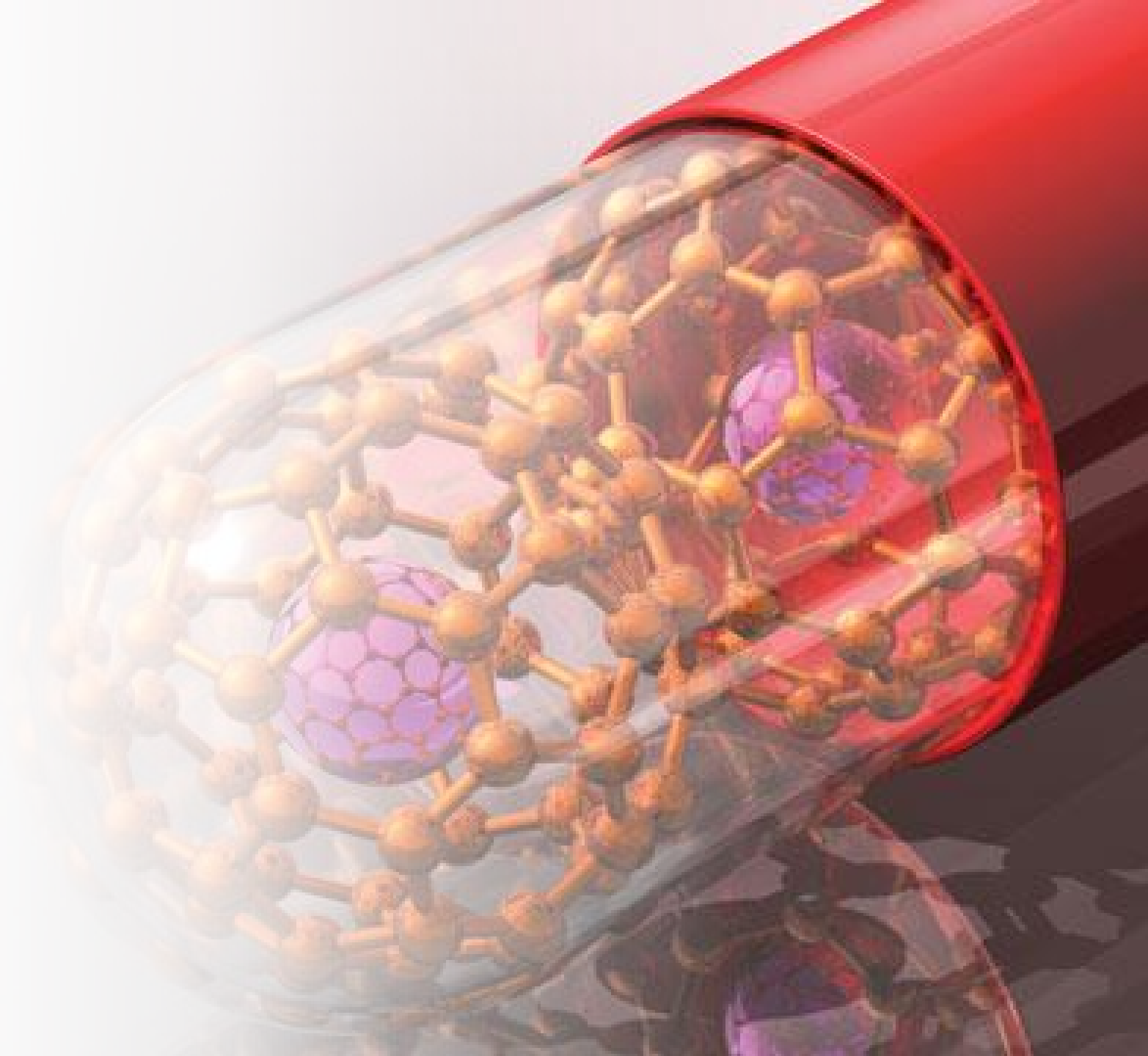


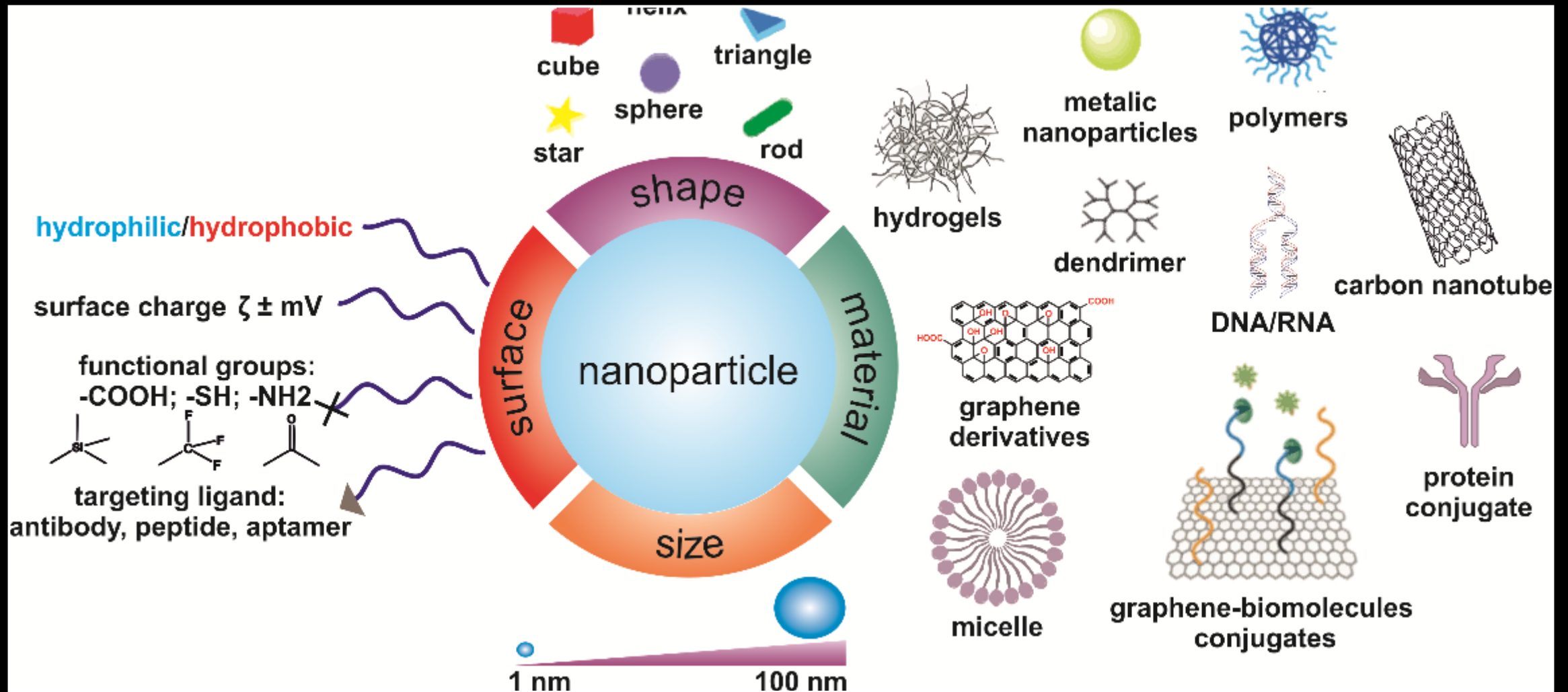
EYE OF SCIENCE / SCIENCE PHOTO LIBRARY

Nano Spider.....I mean Geckoman

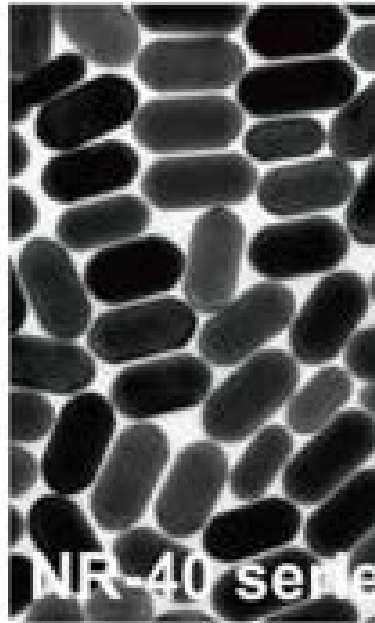
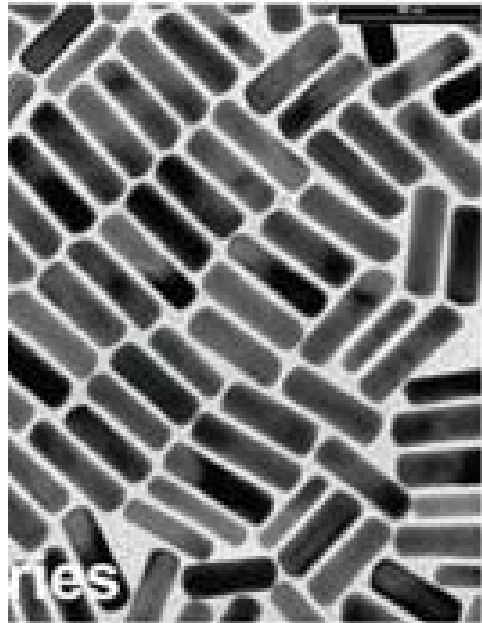
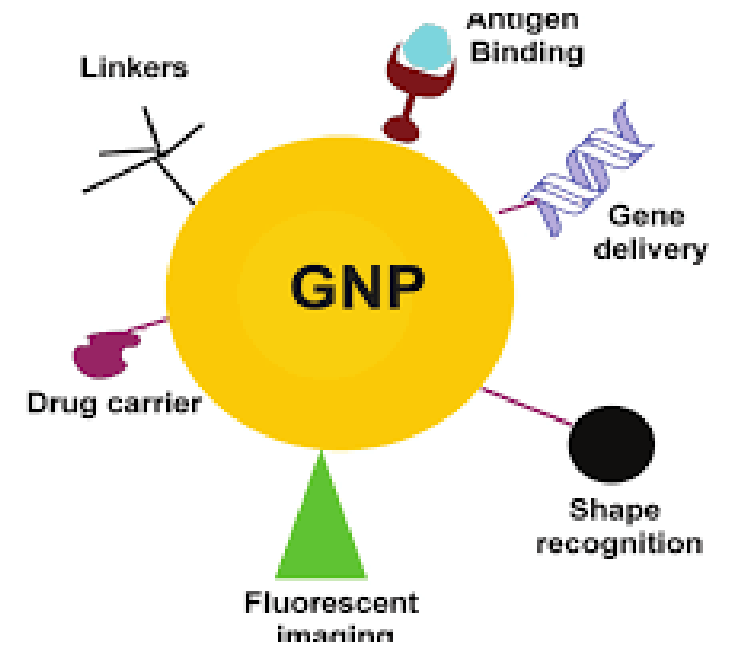
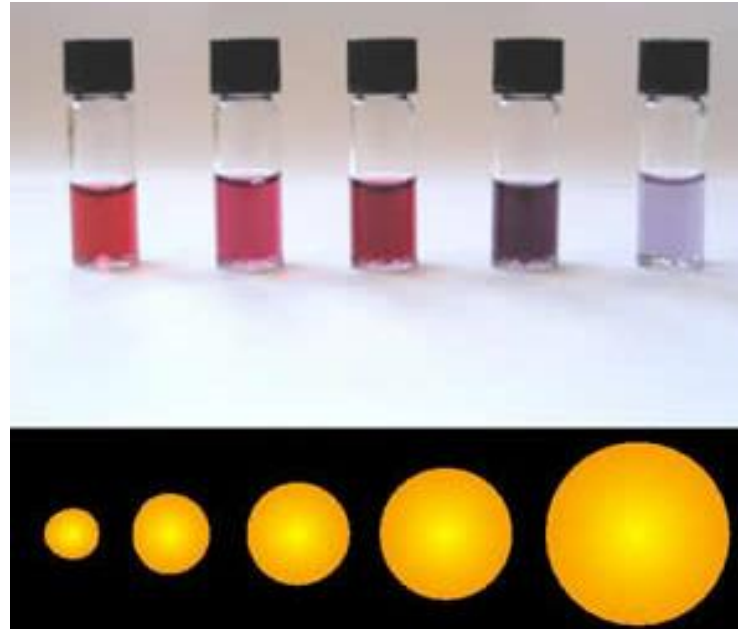
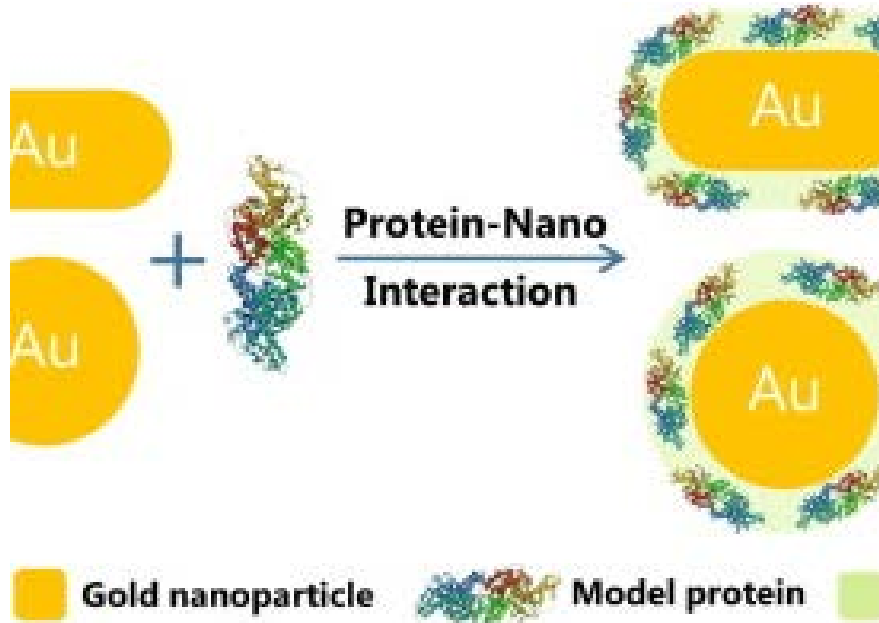


Nanotechnology and Medicine



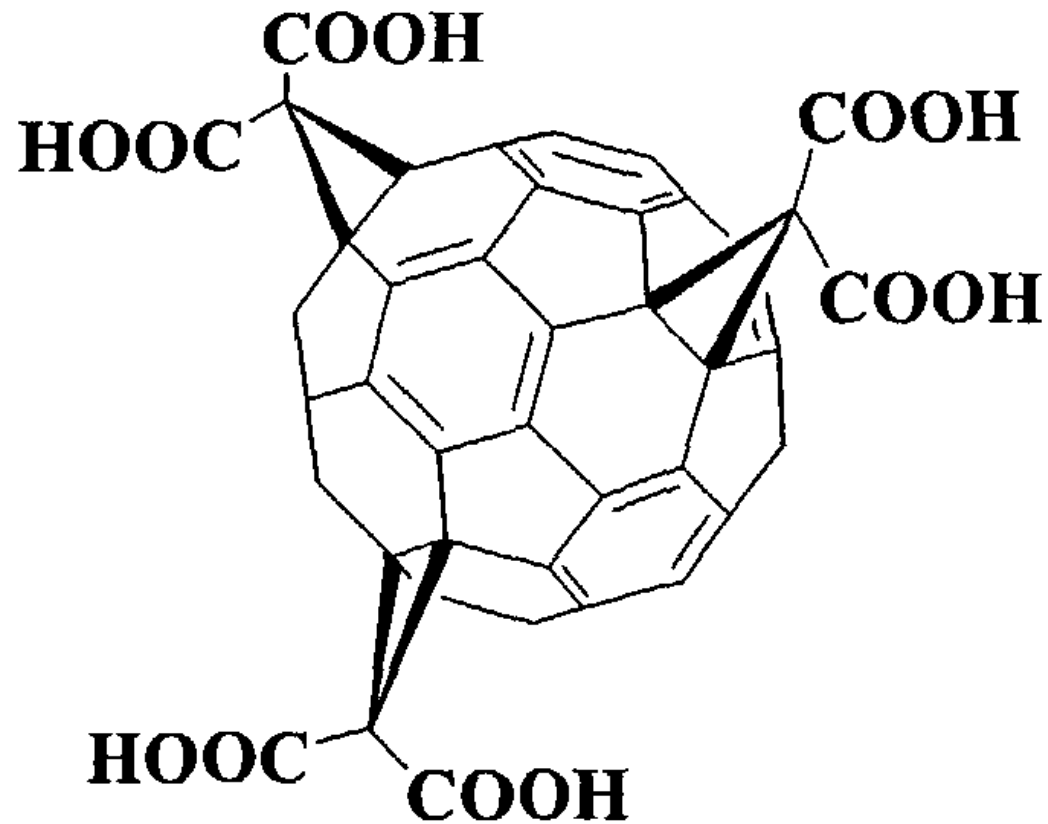


What can we Change?

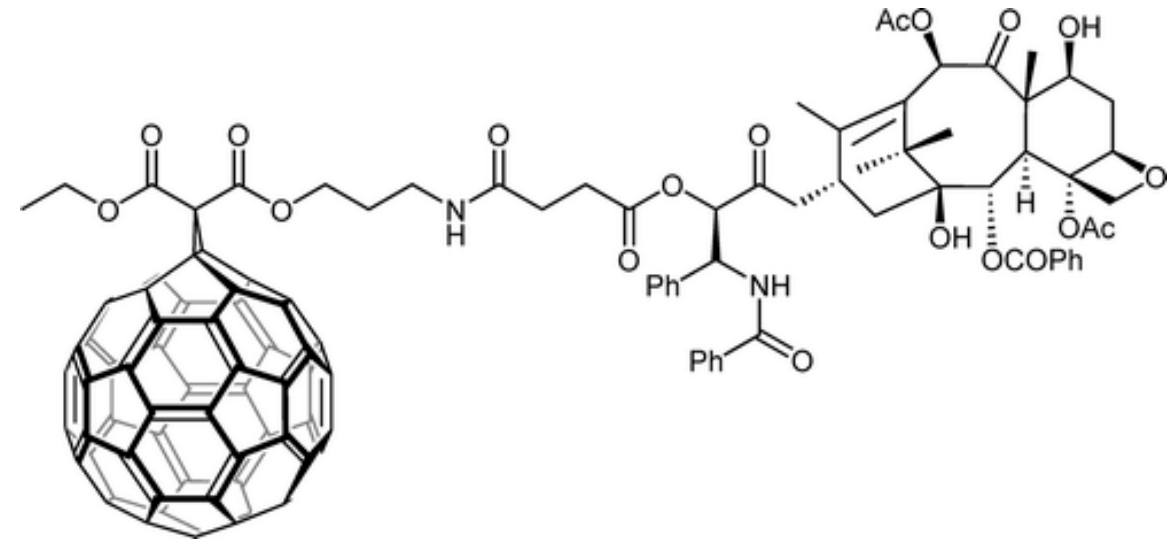


Inorganic Nanoparticles

Can Add External Molecules

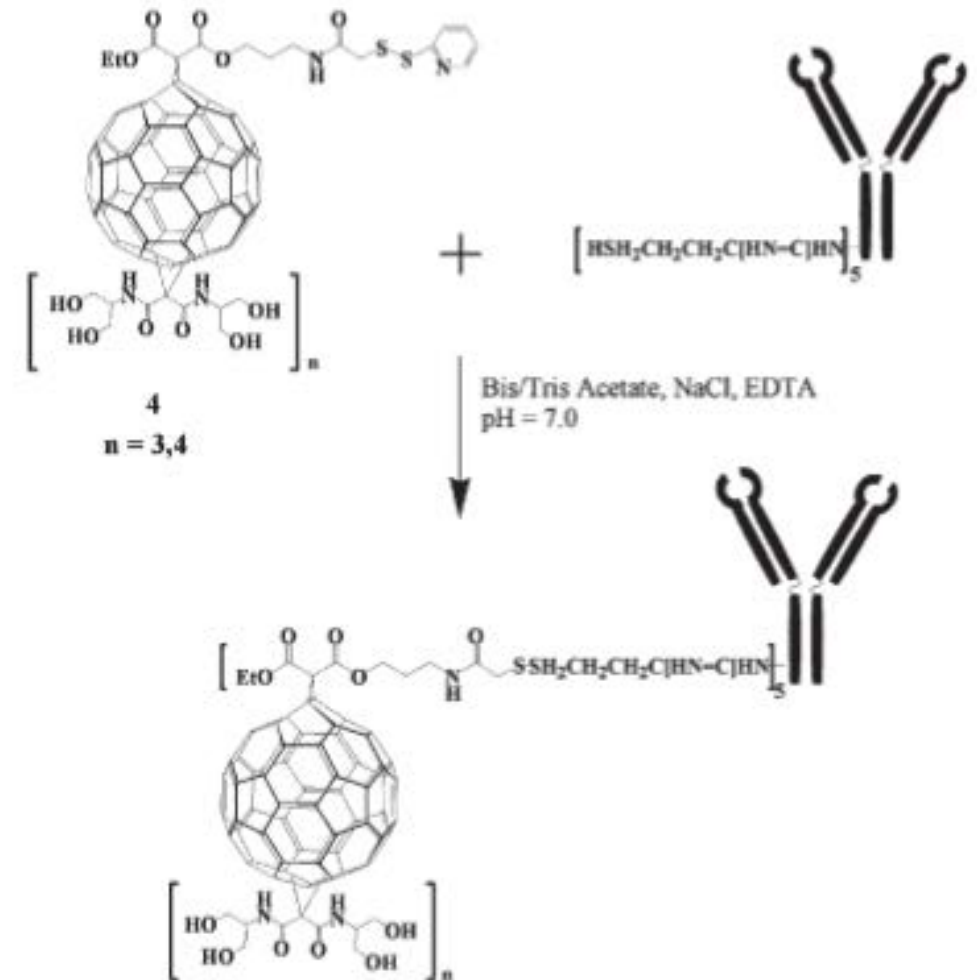
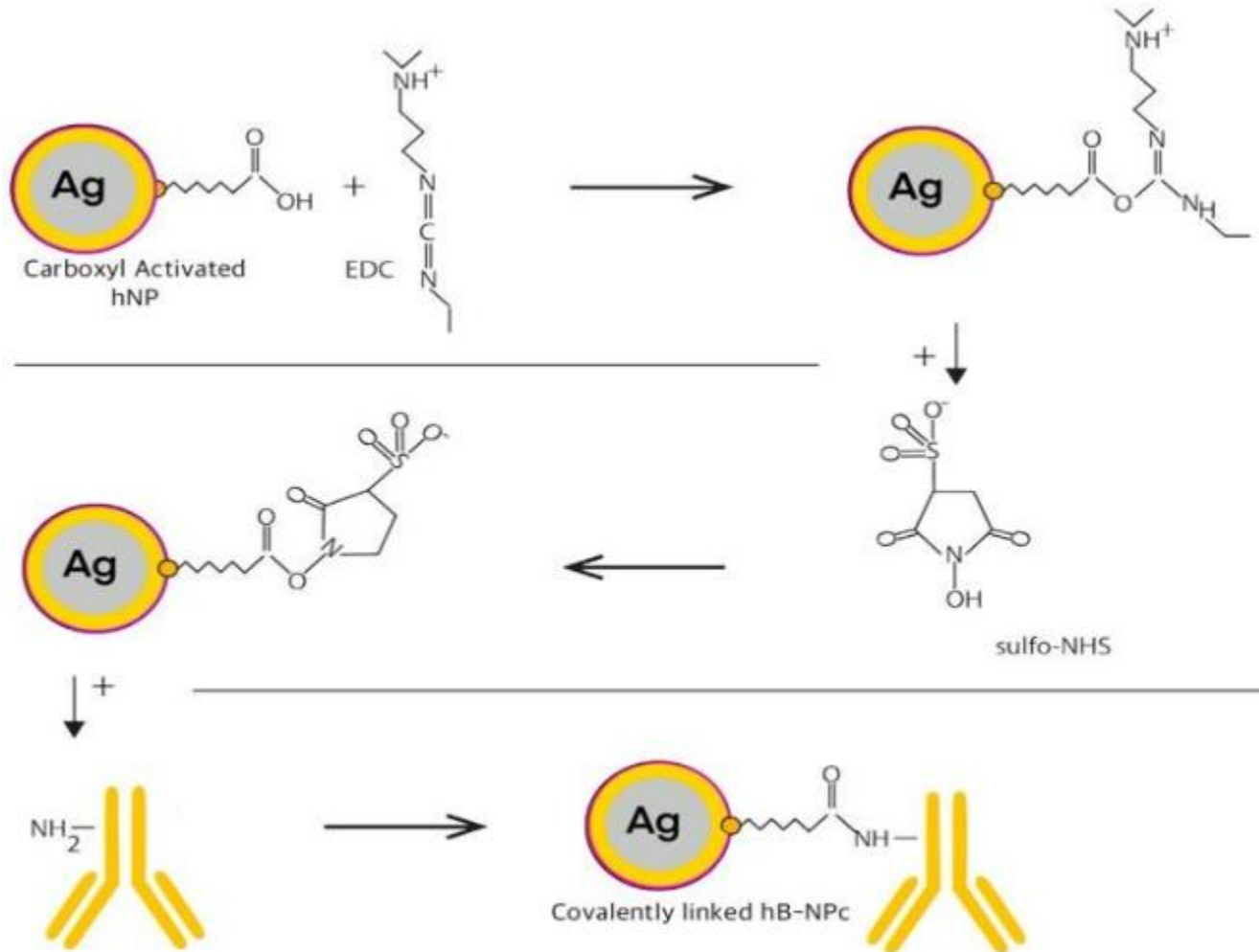


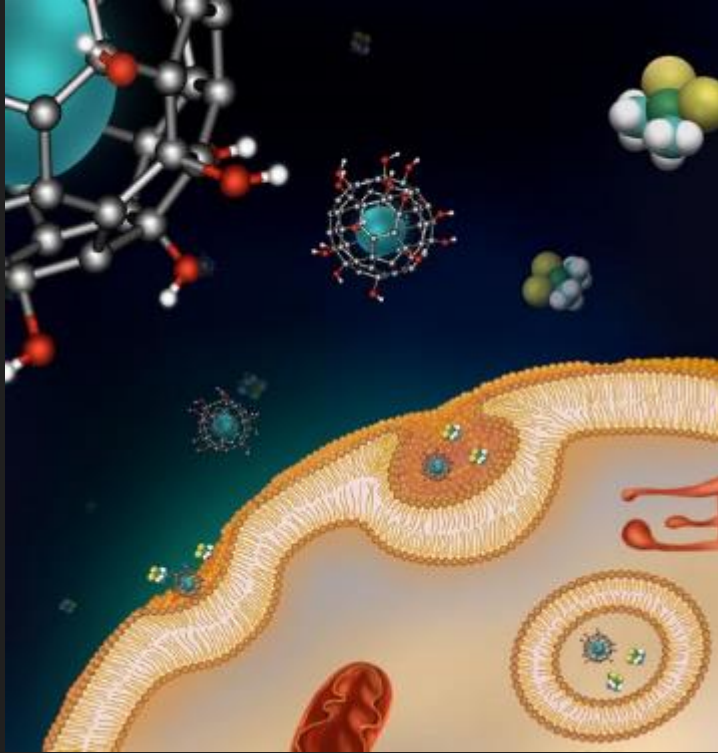
C₃ molecule-Alzheimers



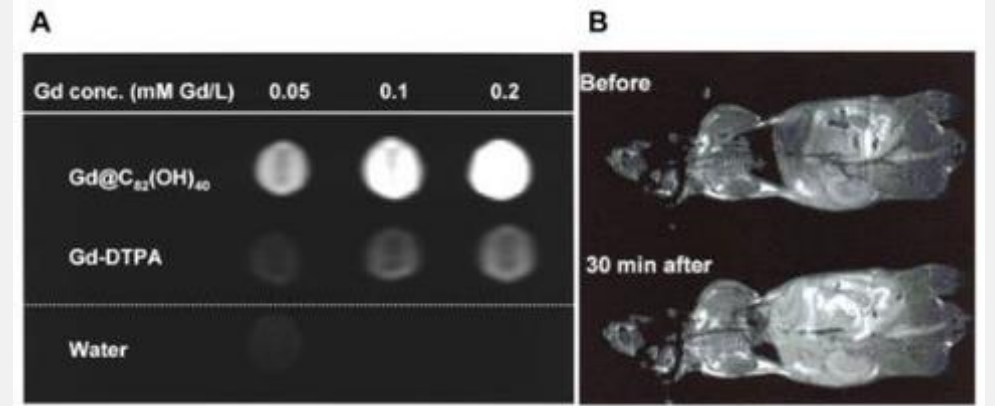
Fullerene-Taxol Conjugate

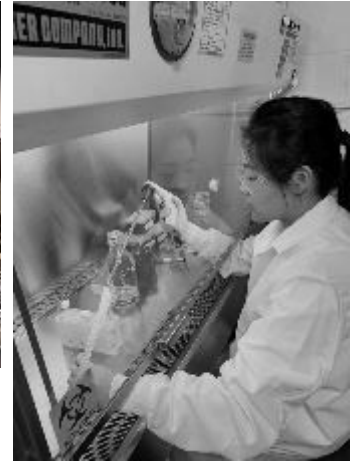
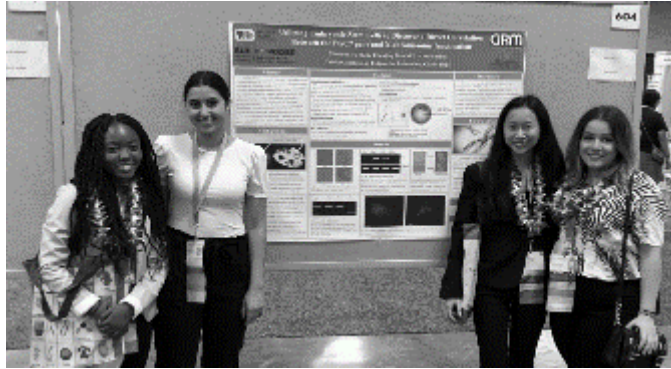
Nanoparticle-Bioconjugates





Cell Specific Nano Drug Delivery





Nanotechnology in Automobiles

Nano goes vroom!

Nano in a car (in a minivan)

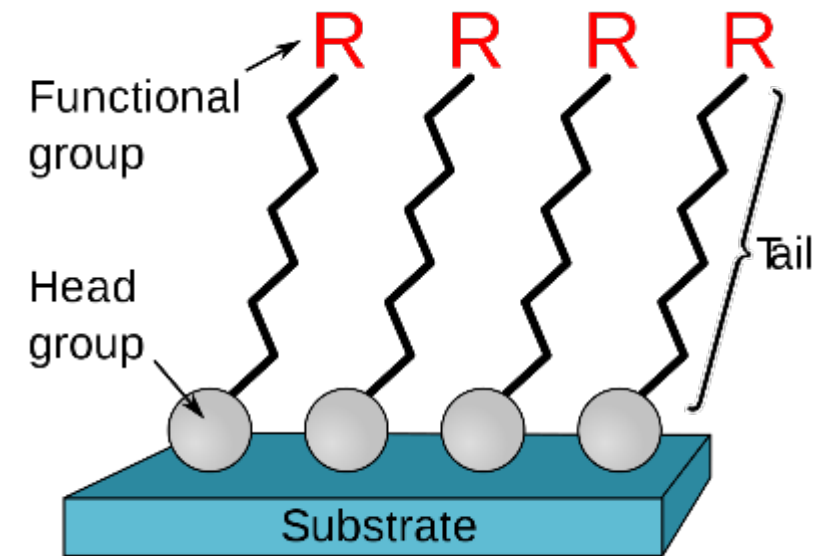
Windshield



Lights

Tires

Rain-X



Hydrophobic self-assembled monolayer

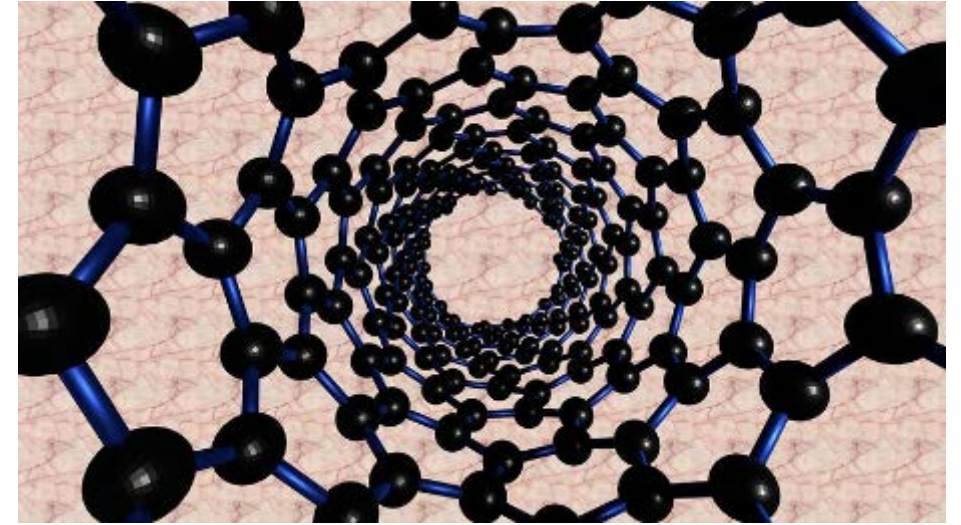
https://en.wikipedia.org/wiki/Self-assembled_monolayer

<https://www.autoguide.com/auto-news/2018/03/does-rain-x-really-work-.html>



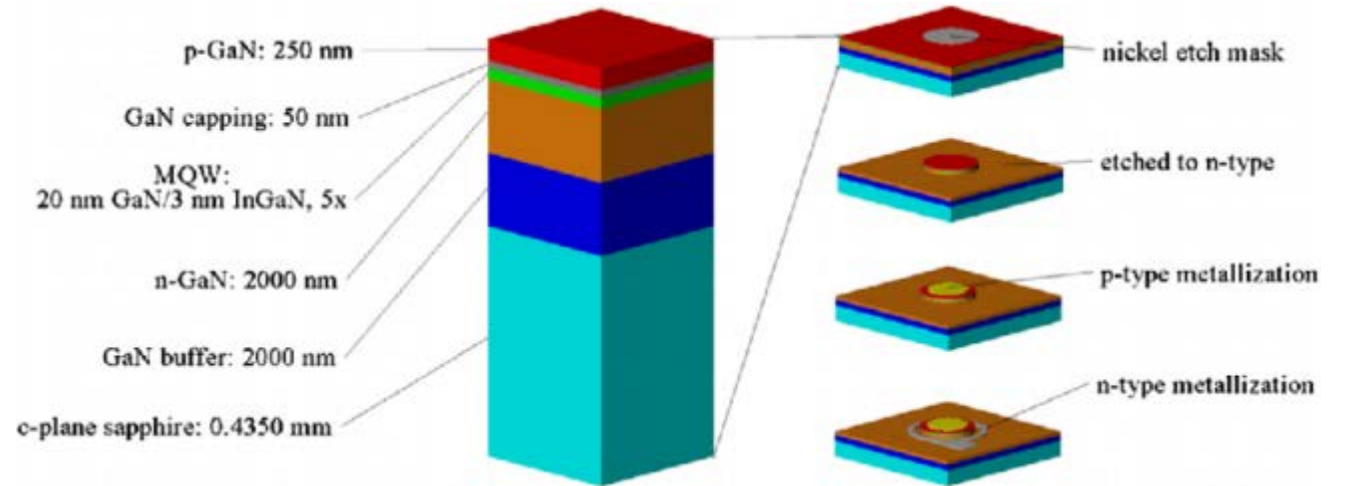
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Tires



Carbon nanotubes to replace carbon black in tires

Lights



Layers of nanoscale semiconductors

<https://www.amazon.com/AKKON-Halogen-Headlights-Passenger-Replacement/dp/B01G9H DU72>

https://www.researchgate.net/figure/Schematic-depicting-the-micro-LED-growth-stack-left-and-postgrowth-fabrication-process_fig1_231063723



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Nanotechnology in Electronics

Nano connections, nano notifications

Nano in your phone



screen

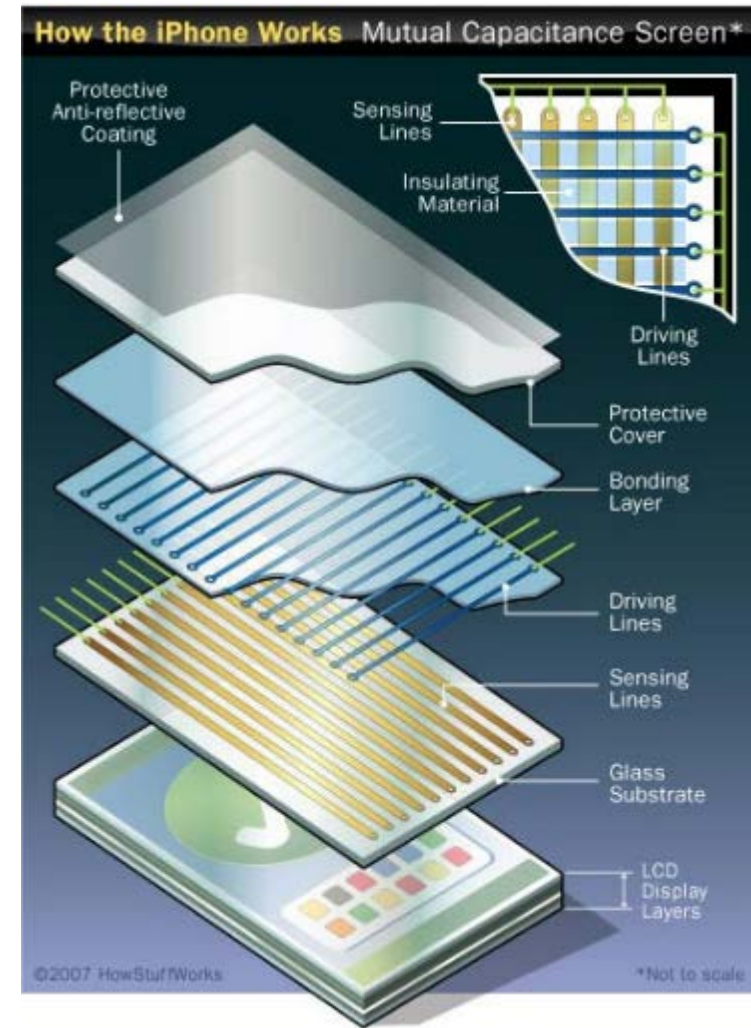
memory

processor



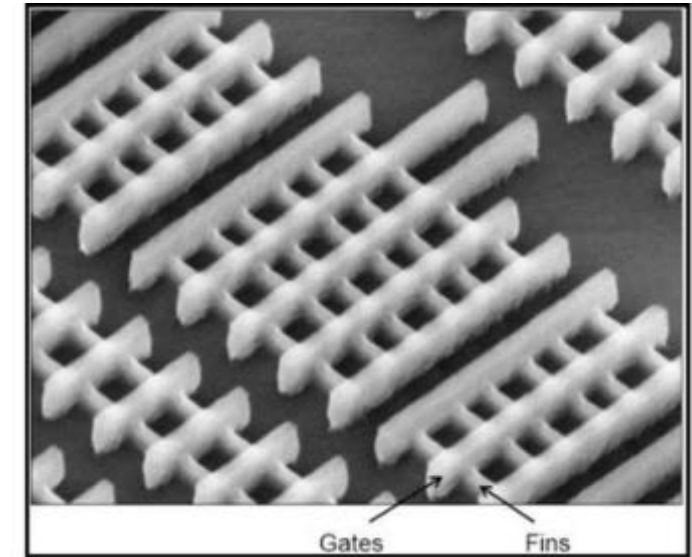
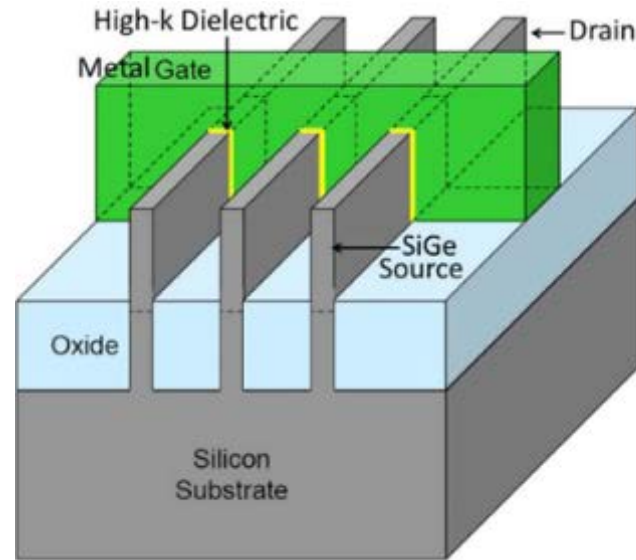
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Screen



Nanoscale transparent conductors

Processor



Nanoscale transistors

https://www.researchgate.net/figure/Schematic-and-SEM-image-of-Intels-22-nm-logic-thin-gate-transistor-After-Ref-2_fig1_332143213

<https://arstechnica.com/gadgets/2013/04/its-just-a-little-touch-how-todays-tech-put-the-world-at-your-finger/>



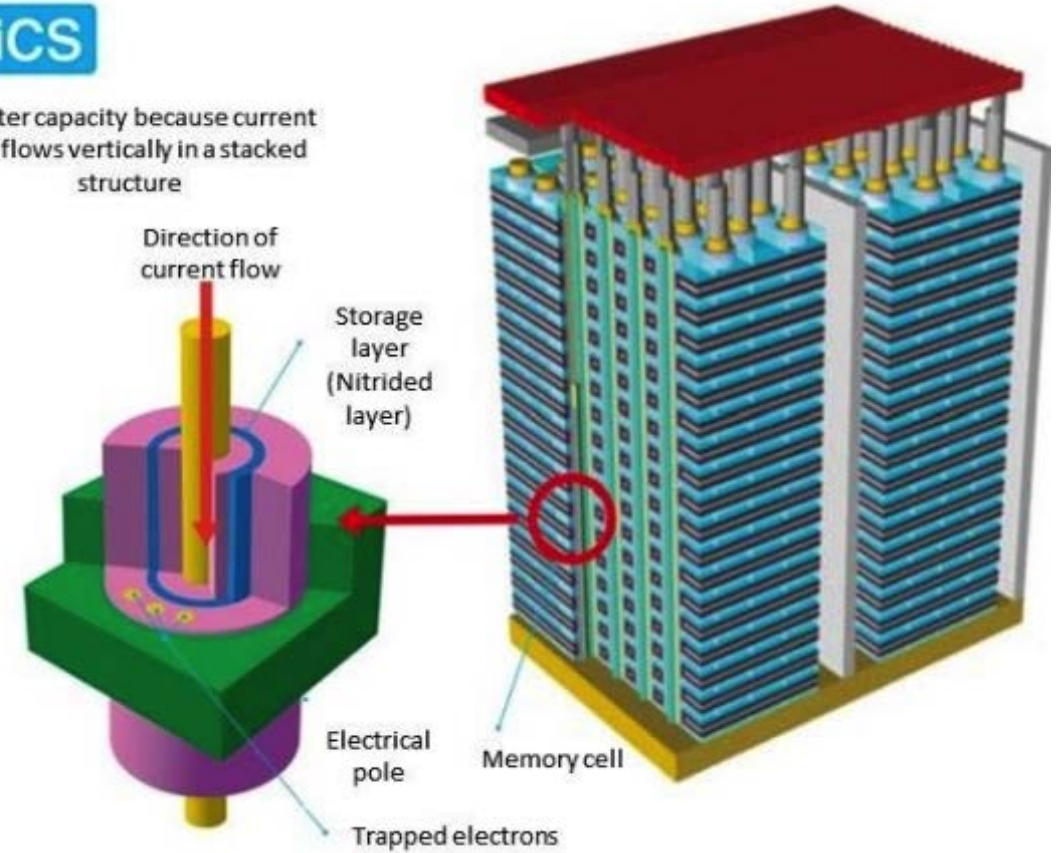
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Memory



BiCS

Greater capacity because current also flows vertically in a stacked structure



Nanoscale 3D memory

<https://pxhere.com/en/photo/1601899>

<https://www.storagenewsletter.com/2016/08/11/more-on-future-of-toshiba-3d-nand-flash-memory/>



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Thanks! Please keep in touch

#teachnano

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