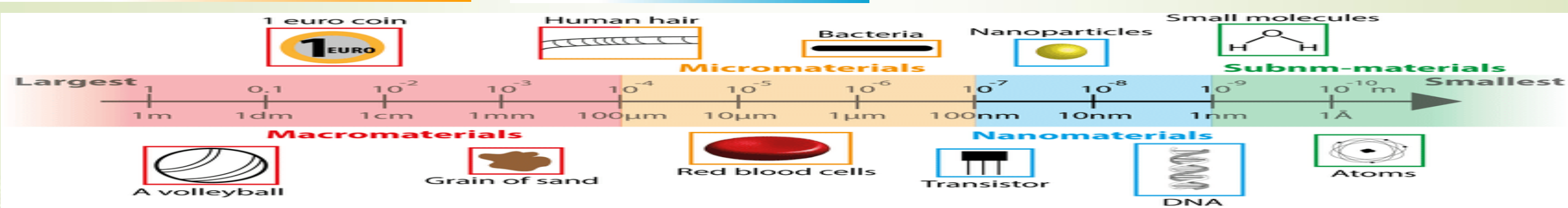
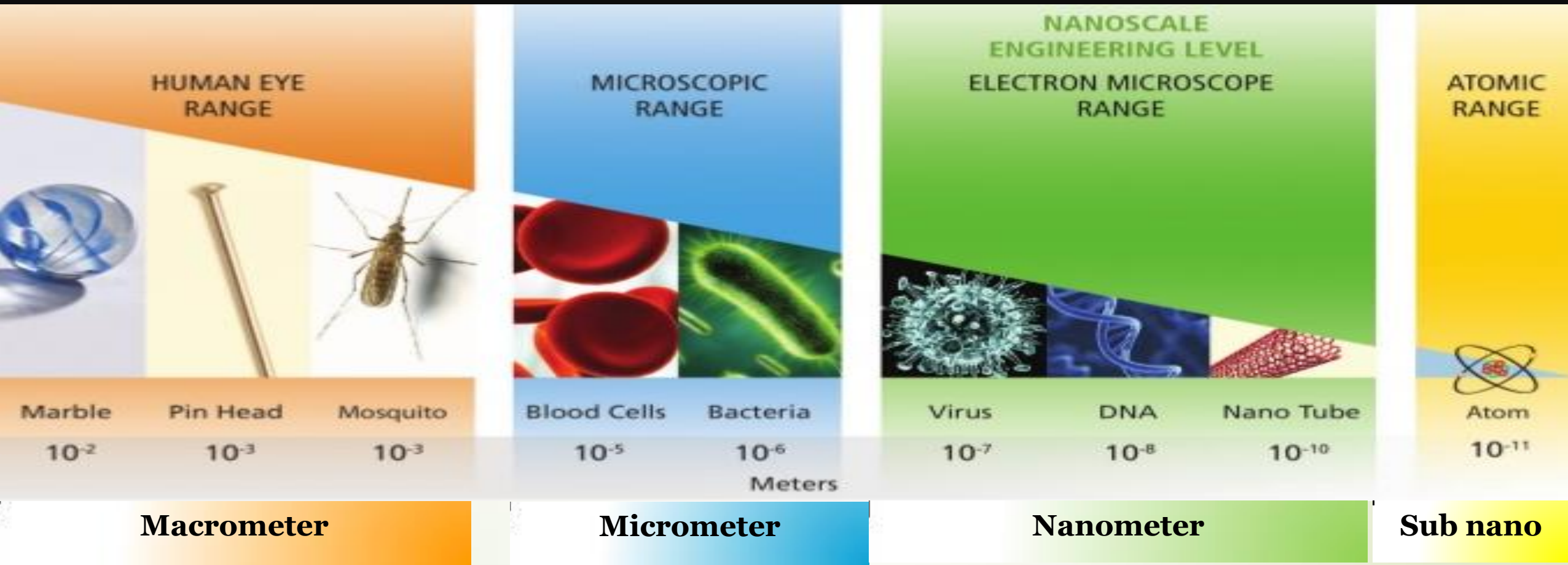
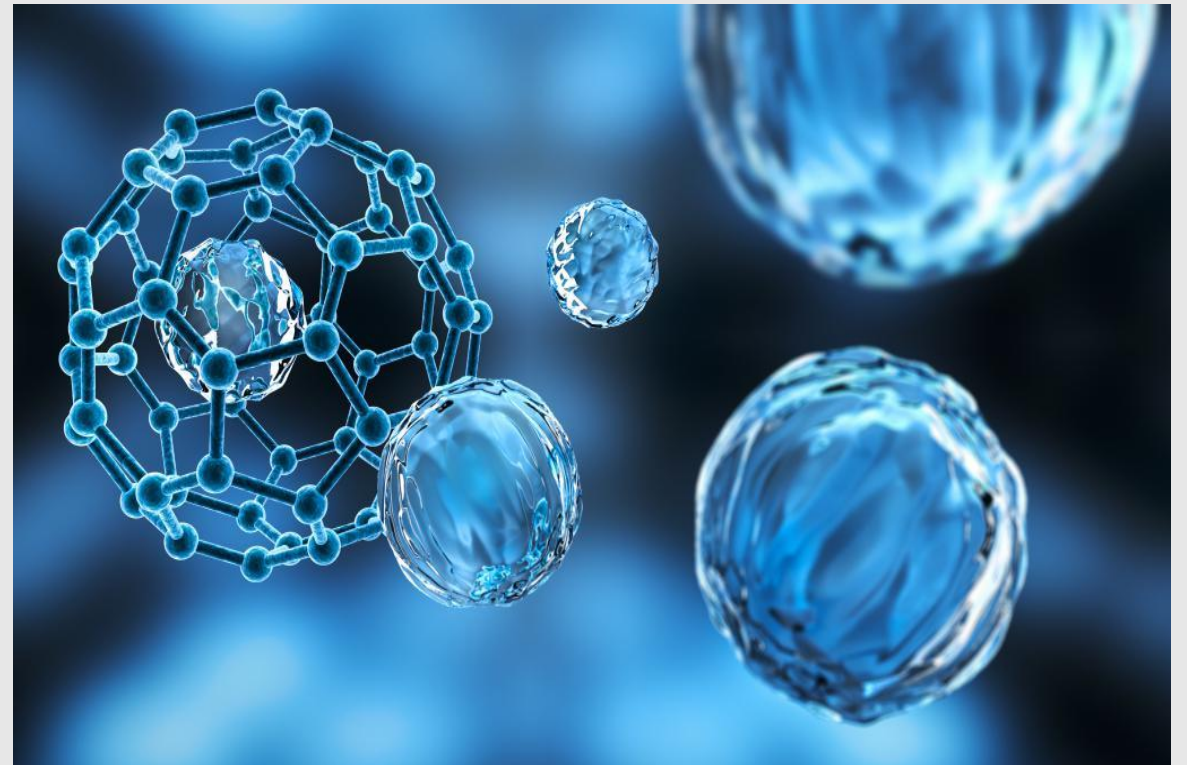


Materials scale



What is Nano mean's

- The prefix nano comes from the Greek word *nanos*, which means one-billionth part of something. So, nanotechnology can be described as engineering and manufacturing at the scale of a nanometer or nanoscale (nanometer = 10^{-9} meter).
- Examples of nano-substance are- Atom diameter 0.15 nm, diameter of double strand DNA 2 nm, and cell 1000 nm.



Fact !

**Why we can't write and
entire the British**

**Encyclopaedia which
include 24 volume on the
pin head**

Dr. Richard P. Feynman

29/9/1959

Nobel Prize 1965



History of Nanotechnology



1959:
Richard Feynman
gave a talk on
Nanotechnology



1974:
Norio Taniguchi
coined the term
Nanotechnology



1991:
Sumio Iijima
discovered the
Carbon Nanotube

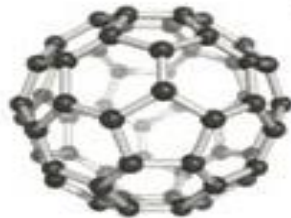


2006:
**Naomi Halas and
Jennifer West**
are leading the
field in Nanoparticles
combating Cancer

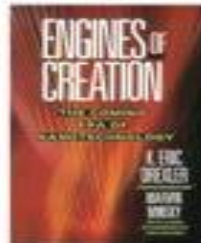
1959



1960:
William McLellan
constructed the first
250-microgram motor



1985:
**Researchers at
Rice University**
discovered fullerenes or
more commonly know as
buckyballs



1986:
Eric Drexler
made the concept
popular with his
book "Engines of
Creation"

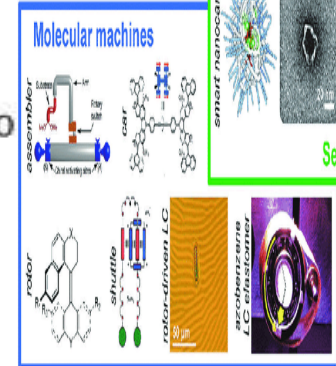
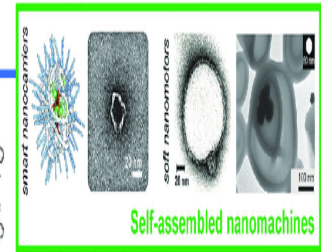
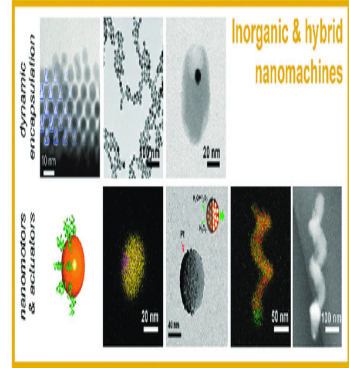


1997:
Zyvex
is founded and is
the first company to
research
Nanotechnology



2005:
Günter Oberdörster
coined the term
"Nanotoxicology"

2010

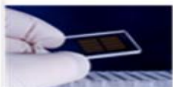


feature size

Nanotechnology

Nanodevices

Microarrays



Microscopic devices



Intelligent machines



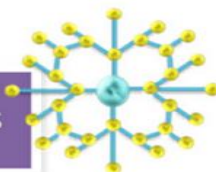
Nanomaterials

Nanostructured

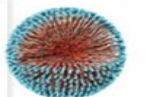
Nanocrystalline

Polymer-based

Dendrimers



Nanoparticles



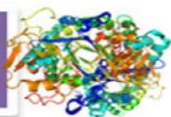
Micelles



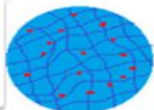
Drug conjugates



Protein nanoparticles

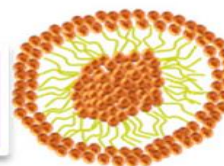


Nanogels

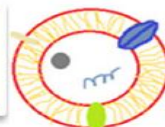


Lipid-based

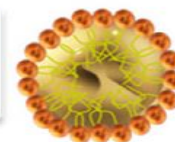
Liposomes



Exosomes

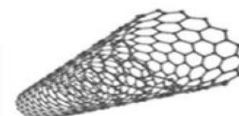


Solid lipid nanoparticles



Non polymeric

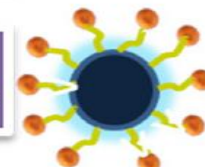
Carbon nanotubes



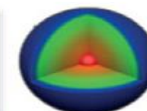
Nanodiamond



Metallic nanoparticles

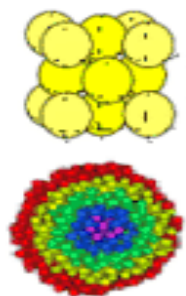


Quantum dots



Silica based nanoparticles



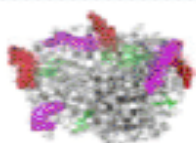


1st: **Passive nanostructures** (1st generation products)

- a. *Dispersed and contact nanostructures.* Ex: aerosols, colloids
- b. *Products incorporating nanostructures.* Ex: coatings; nanoparticle reinforced composites; nanostructured metals, polymers, ceramics

↑
Frame 1

~ 2000



2nd: **Active nanostructures**

- a. *Bio-active, health effects.* Ex: targeted drugs, biodevices
- b. *Physico-chemical active.* Ex: 3D transistors, amplifiers, actuators, adaptive structures

↓
↑
Frame 2

~ 2005



3rd: **Systems of nanosystems**

Ex: guided assembling; 3D networking and new hierarchical architectures, robotics, evolutionary



↑
Risk Governance Frame 2

~ 2010

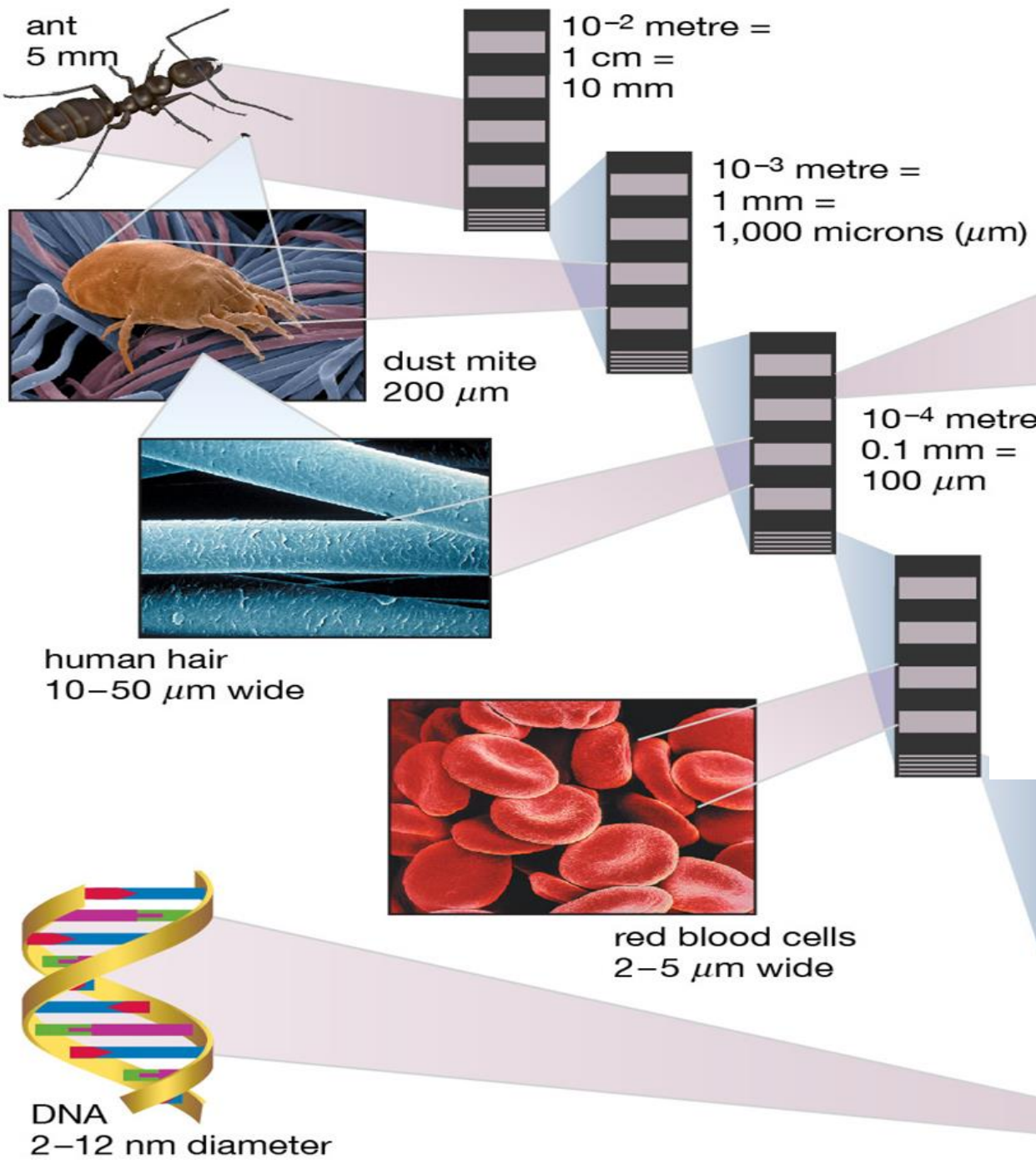


4th: **Molecular nanosystems**

Ex: molecular devices 'by design', atomic design, emerging functions

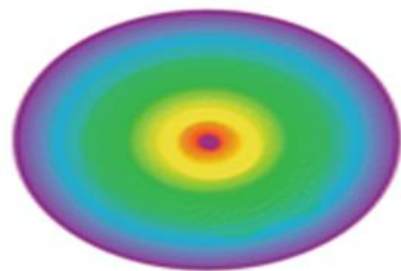
~ 2015-2020

↓

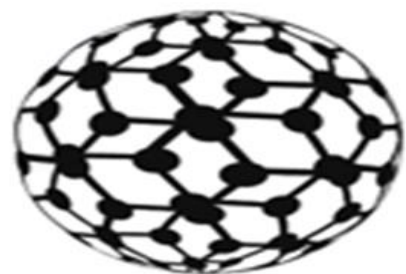


0D

Nanospheres,
clusters



Quantum dots



Fullerenes



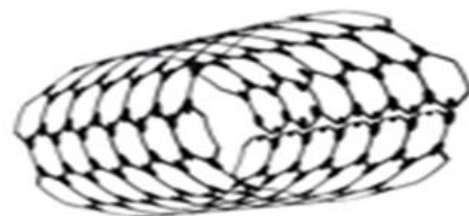
Gold nanoparticles

1D

Nanotubes,
wires, rods



Metal nanorods,
Ceramic crystals



Carbon nanotubes,
Metallic nanotubes



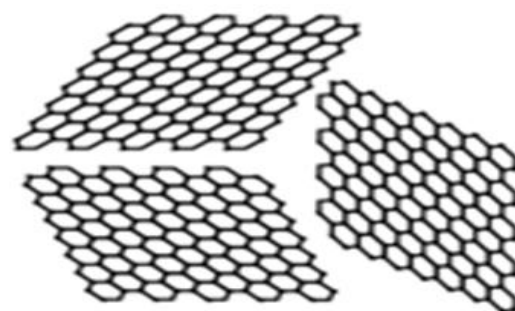
Gold nanowires,
Polymeric nanofibers,
Self assembled structures

2D

Thin films, plates,
layered structures



Carbon coated
nanoplates



Graphene sheets



Layered nanomaterials

3D

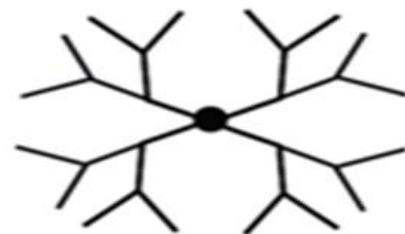
Bulk NMs,
polycrystals



Liposome

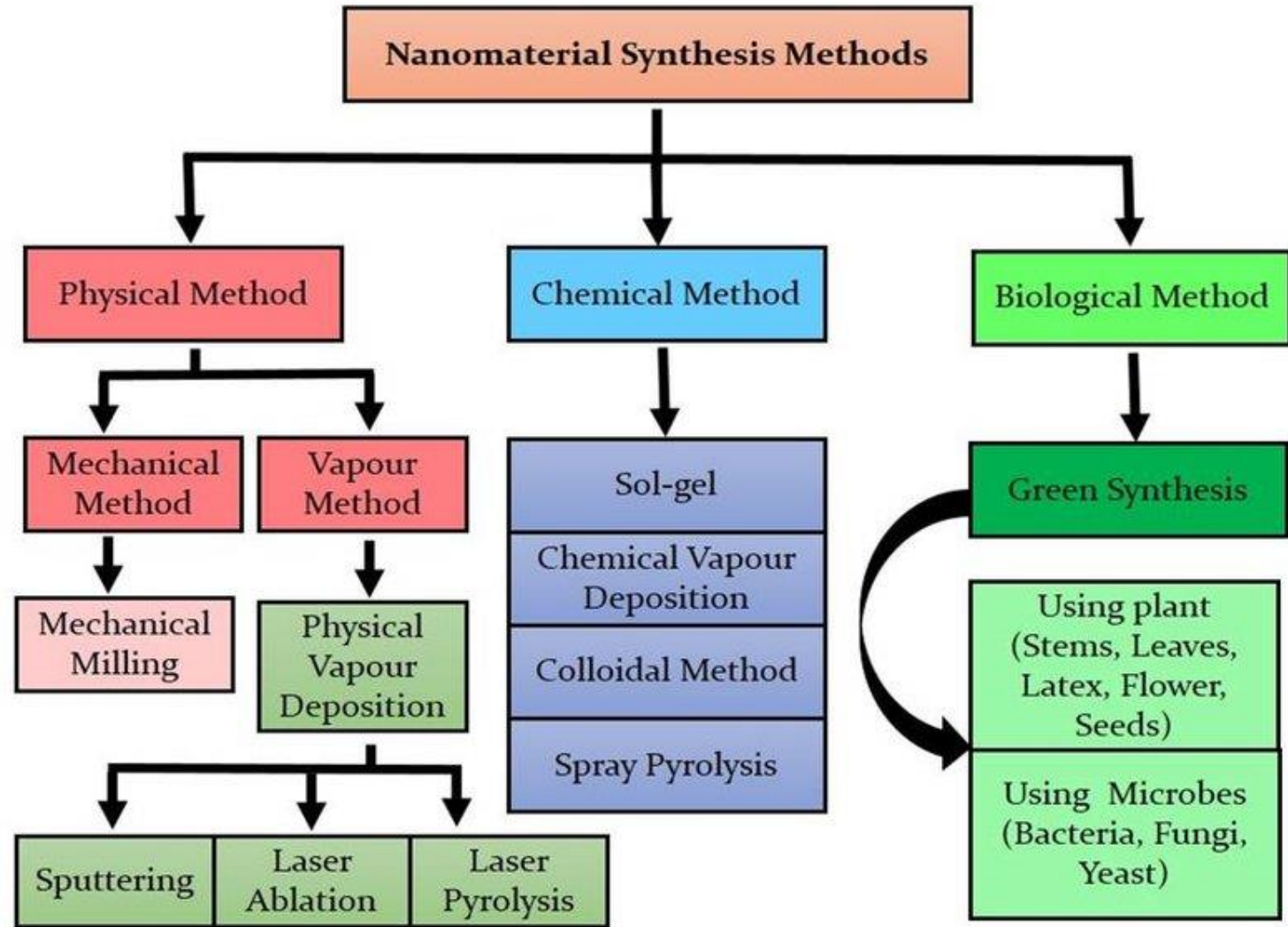


Polycrystalline



Dendrimer

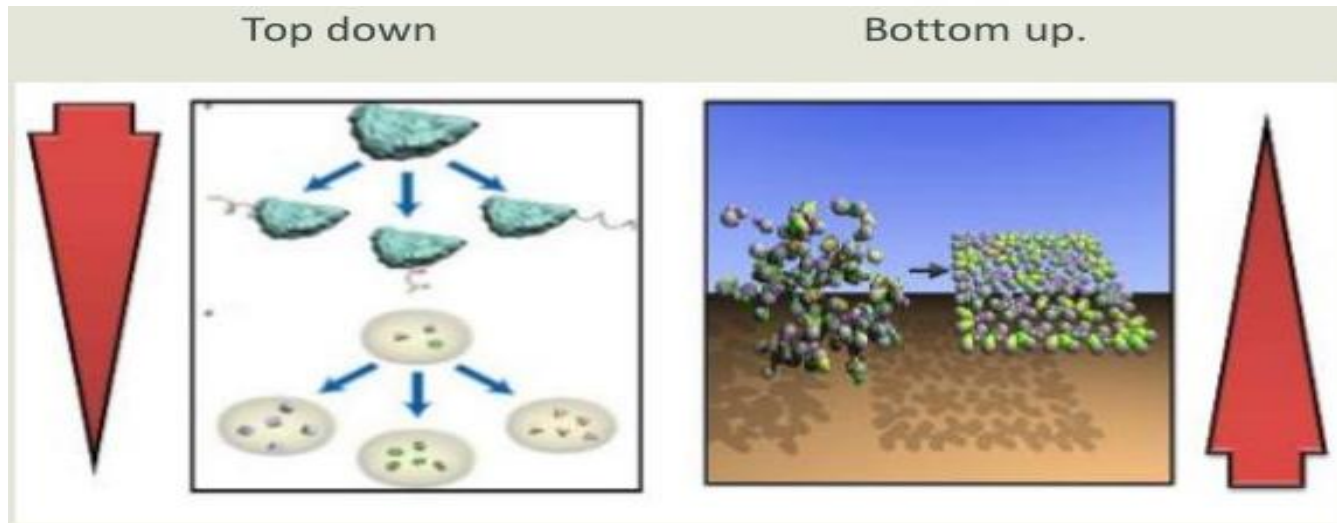
METHODOLOGY



Fabrication of Nanomaterials

* 2 approaches

- bottom up approach
- top down approach

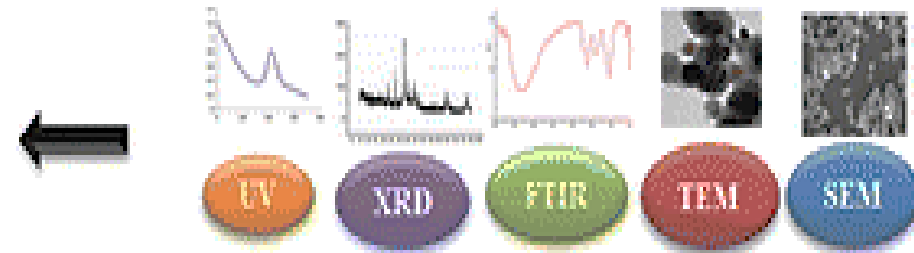
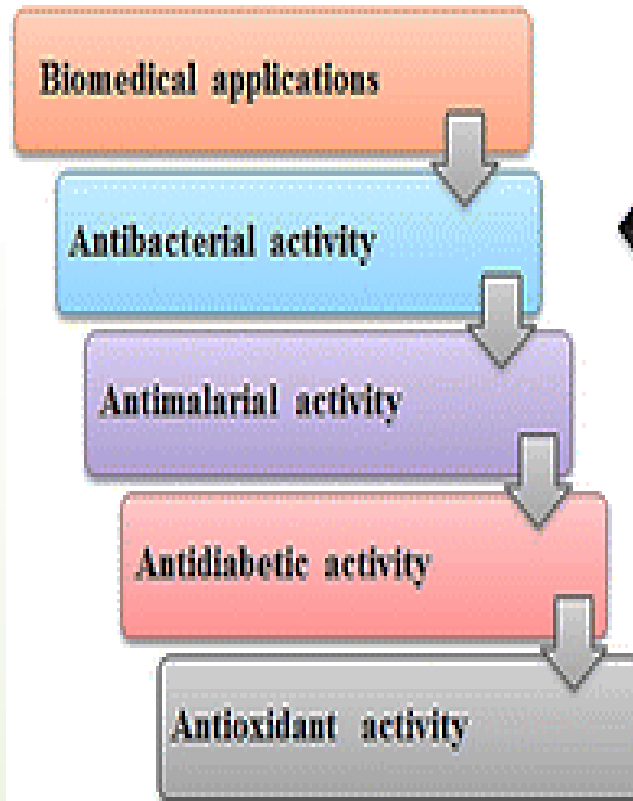
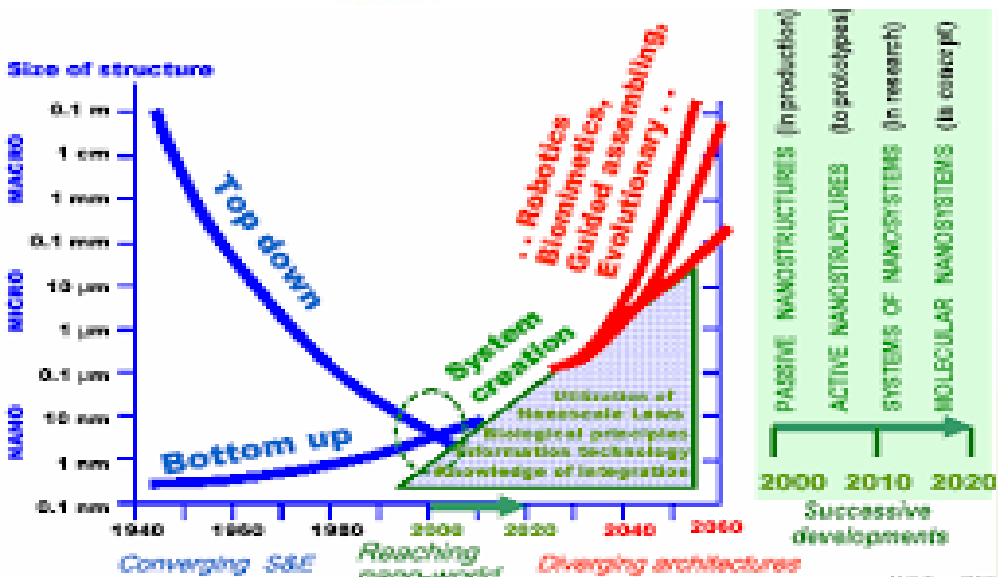
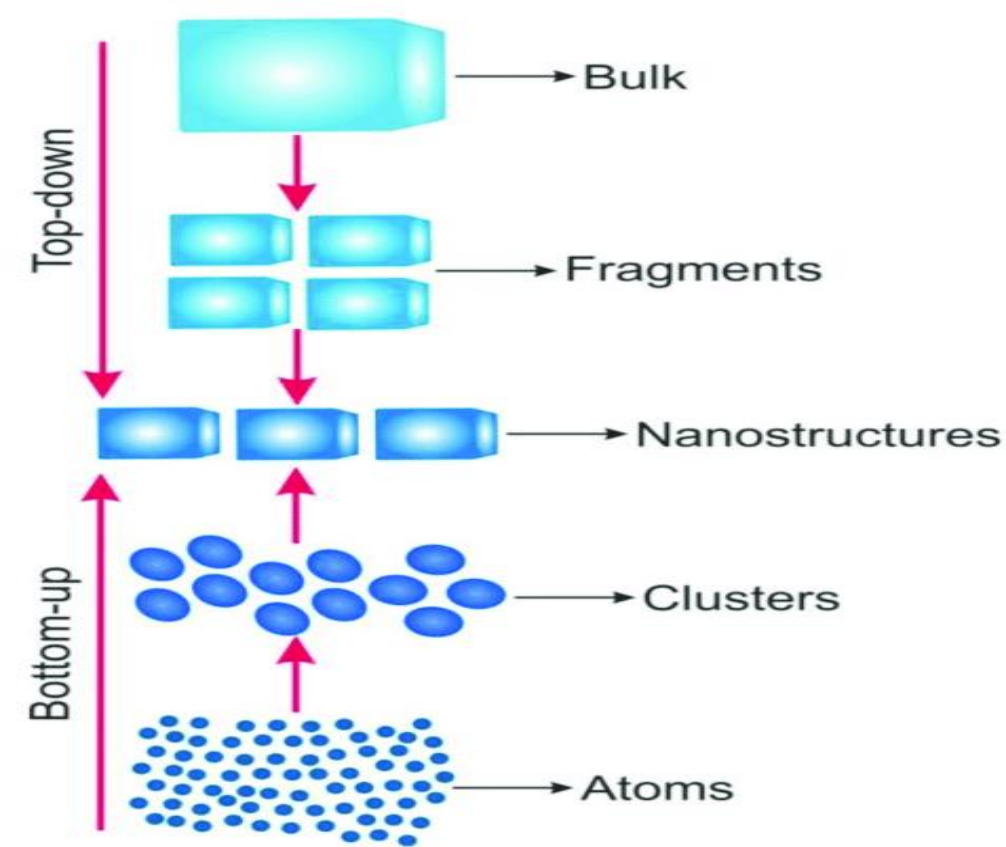


Bottom Up



Top Down

Nanomaterials Fabrication



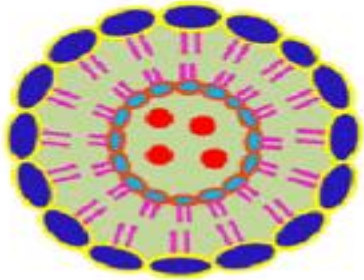
Equipment's for Nanoparticles

1. Homogenizer
2. Ultra Sonicator
3. Mills
4. Spray Milling
5. Supercritical Fluid Technology
6. Electro spray
7. Ultracentrifugation
8. Nanofiltration

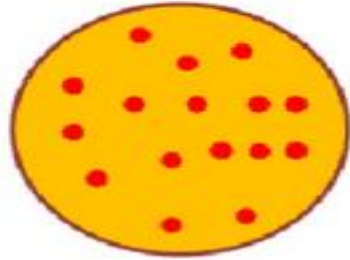


Nanoparticles

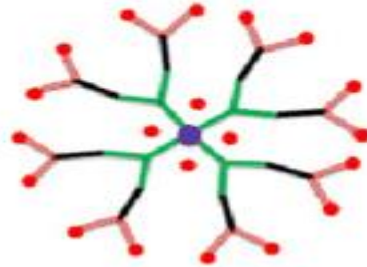
Liposome



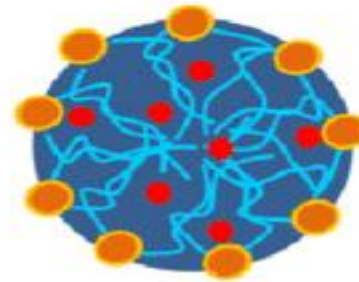
Polymeric nanoparticle



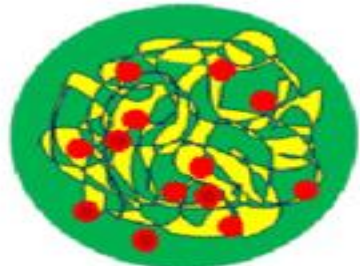
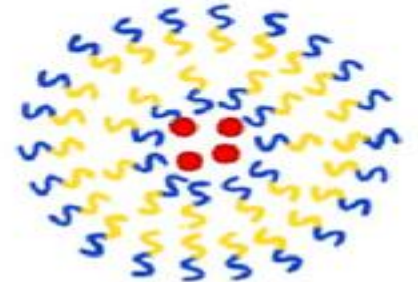
Dendrimer



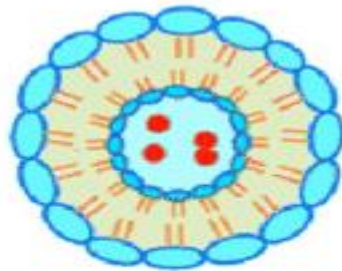
Nanomicelle



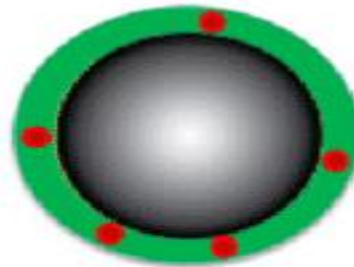
Polymersome



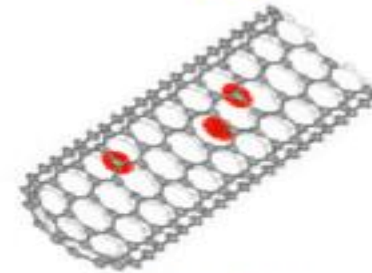
Nanogel



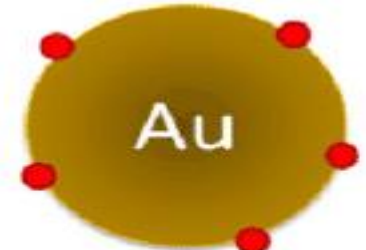
Exosome



Magnetic nanoparticle



Carbon nanotube



Gold nanoparticle

Bionanomaterials

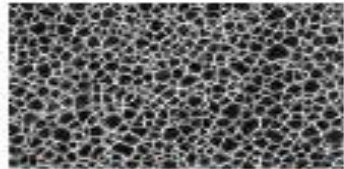
Bionanomaterials

1) Biological materials utilized in nanotechnology

- Proteins, enzymes, DNA, RNA, peptides

2) Synthetic nanomaterials utilized in biomedical applications

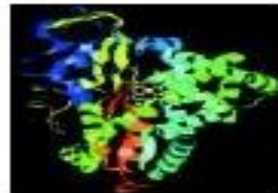
- Polymers, porous silicon, carbon nanotubes



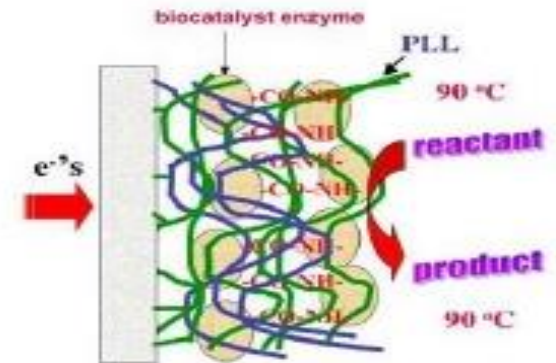
Porous silicon (PSi)



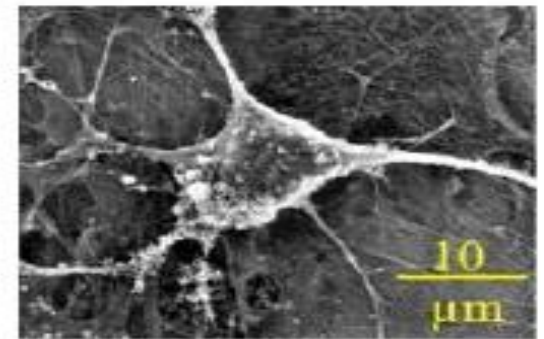
Human cell on PSi



Enzymes are used as oxidation catalysts

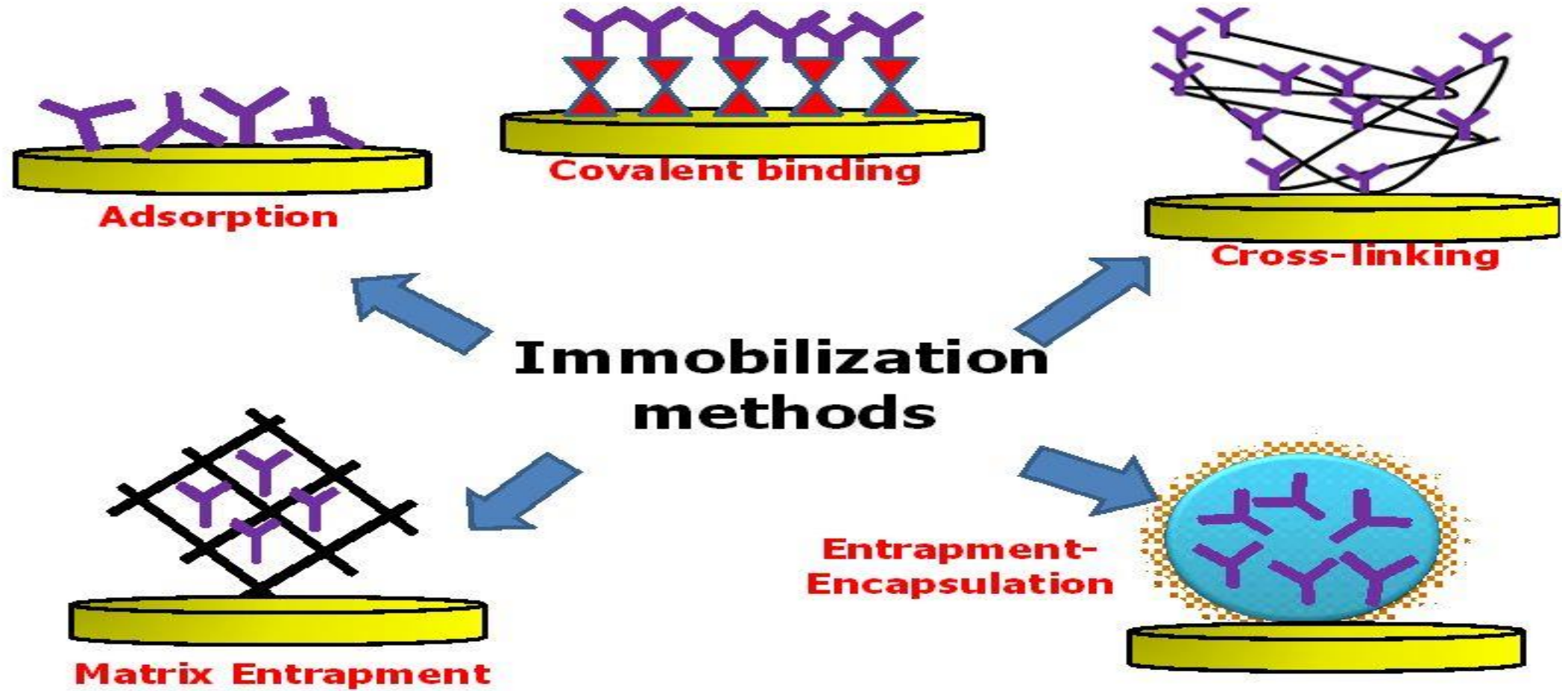


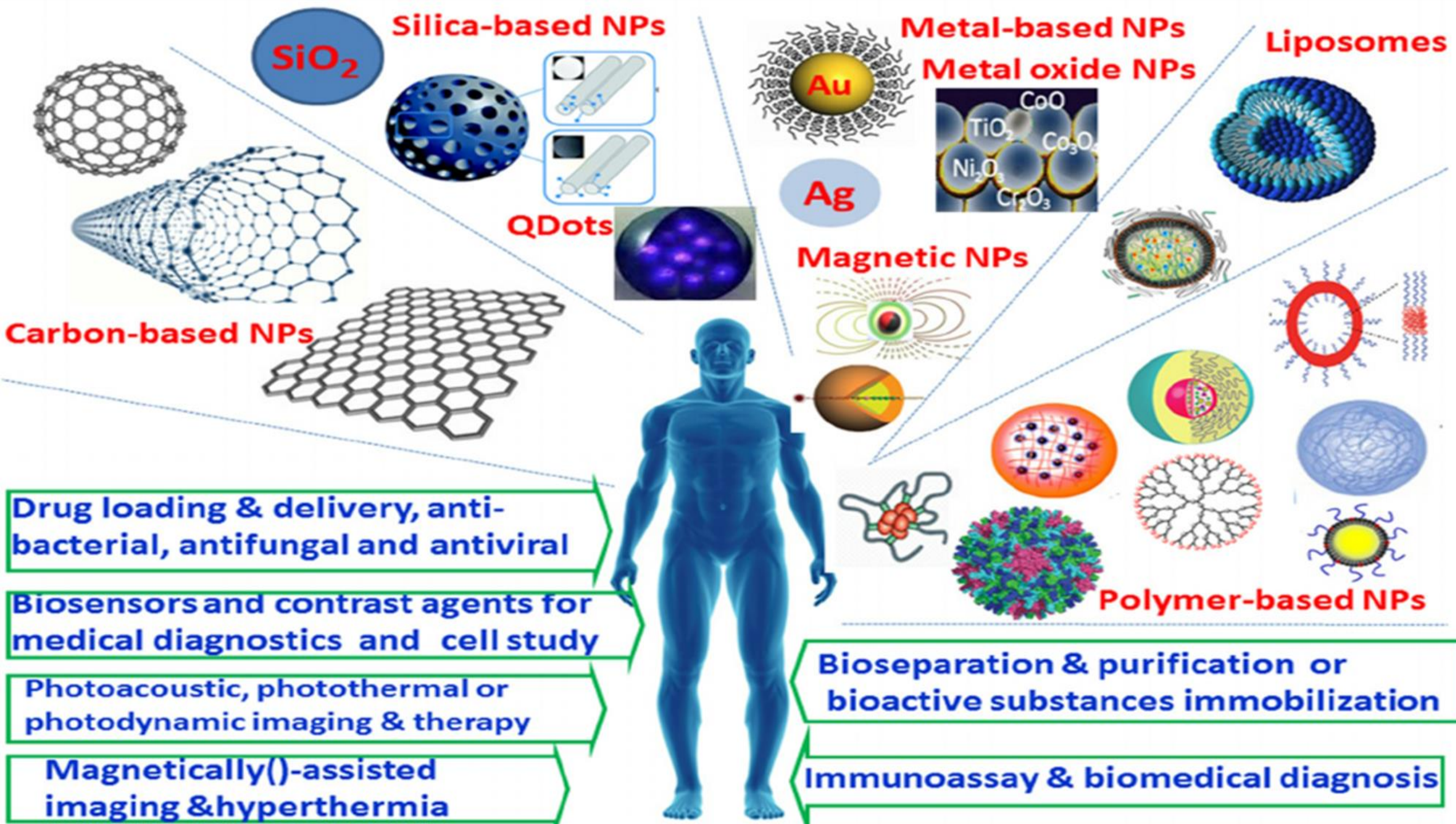
Cross-linked enzymes used as catalyst – Univ. of Connecticut, Storrs, 2007



Bone cell on porous silicon – Univ. of Rochester, 2007

Immobilization Protocol

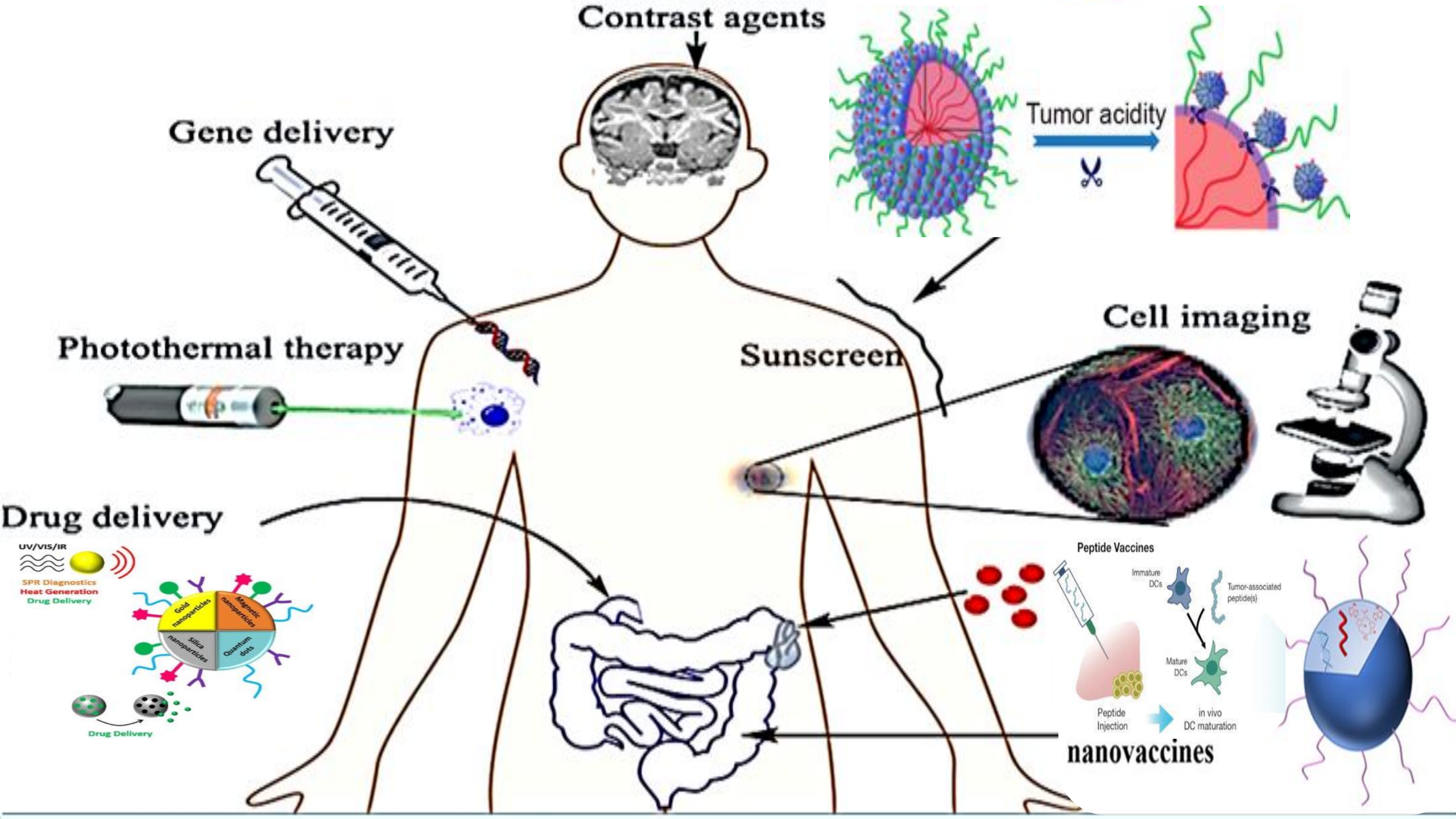




Medical Applications of Nanomaterials

- Nano-medicine,
- Tissue Engineering,
- Nano-robots,
- Advance Diagnostic, As Carrier Of Diagnostic ,
- Biosensor,
- Biomarker,
- Image Enhancement.





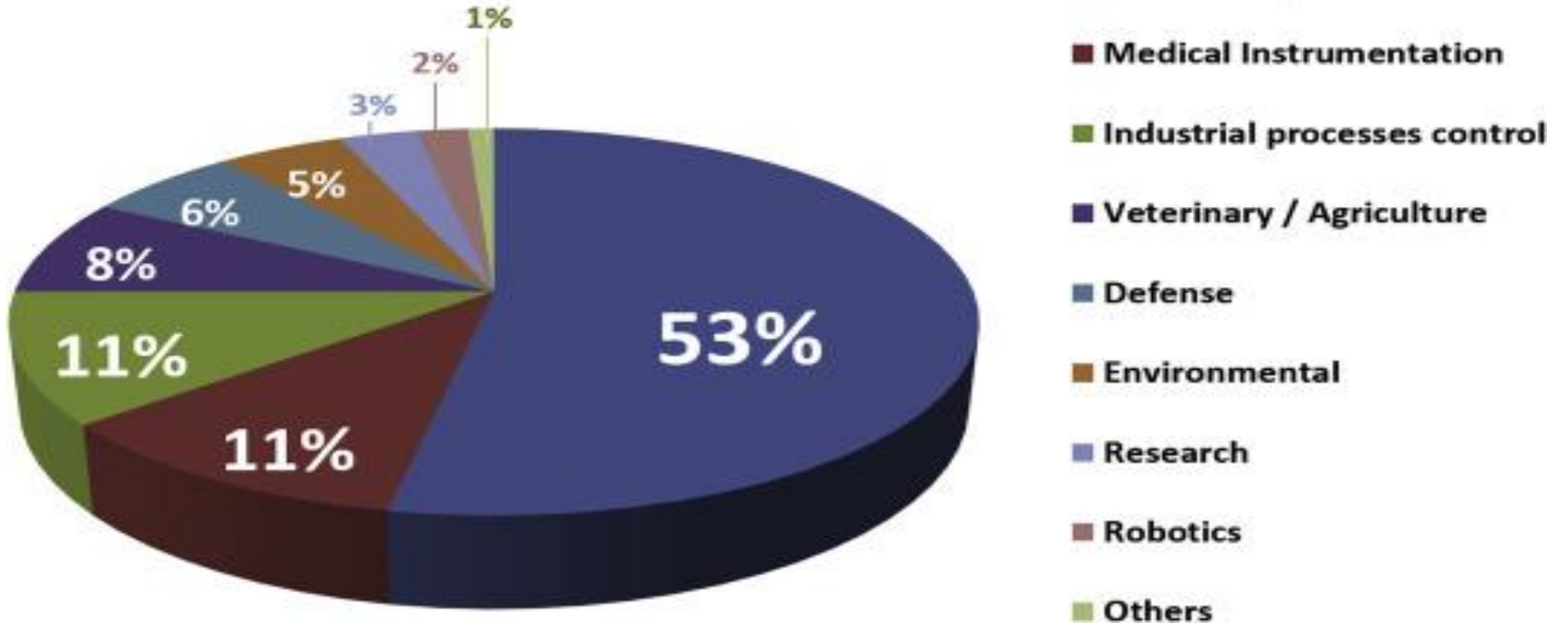
Applications of Nanomaterial Based Products

- Automotive industry
- Engineering
- Medicine
- Cosmetics
- Textile
- Sports
- Chemical industry
- Electronic industry

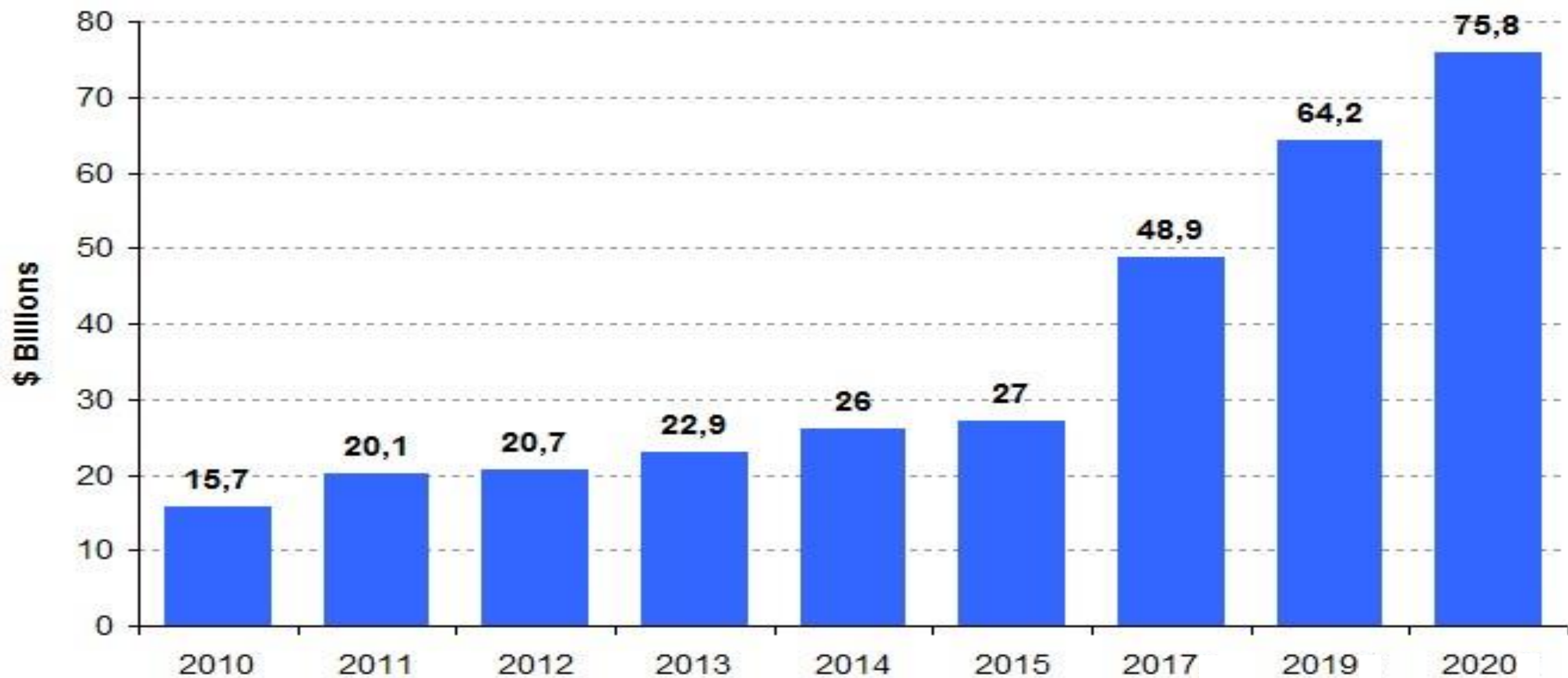
Examples of Nanoproducts on Market



Nanoproducts Marketing



Global nanotechnology market, 2010-2020



ADVANTAGES

- ☺ Nanotechnology can actually revolutionize a lot of electronic products, procedures, and applications.
- ☺ Nanotechnology can also benefit the energy sector.
- ☺ Another industry that can benefit from nanotechnology is the manufacturing sector.
- ☺ In the medical world, nanotechnology is also seen as a boon since these can help with creating what is called smart drugs.

DISADVANTAGES

- ☹ Its development is the possible loss of jobs in the traditional farming and manufacturing industry.
- ☹ Atomic weapons can now be more accessible and made to be more powerful and more destructive.
- ☹ Since these particles are very small, problems can actually arise from the inhalation of these
- ☹ Minute particles, much like the problems a person gets from inhaling minute asbestos particles.
- ☹ Presently, nanotechnology is very expensive and developing it can cost you a lot of money.

References

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- ✓ Roco, M. C. (2017). Overview: Affirmation of Nanotechnology between 2000 and 2030. *Nanotechnology commercialization: manufacturing processes and products*, 1-23.
- ✓ Paul, J. W., & Smith, R. (2018). Preventing preterm birth: New approaches to labour therapeutics using Nanoparticles. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 52, 48-59.

A hand wearing a blue nitrile glove is shown from the left side, holding a glowing, interconnected network of white nodes and lines. The network is composed of numerous small white dots connected by thin white lines, forming a complex, web-like structure. The background is a soft, out-of-focus gradient of light blue and white, with a subtle bokeh effect. The overall aesthetic is clean, modern, and technological.

THE END
BIG THANKS FOR
YOUR ATTENTION