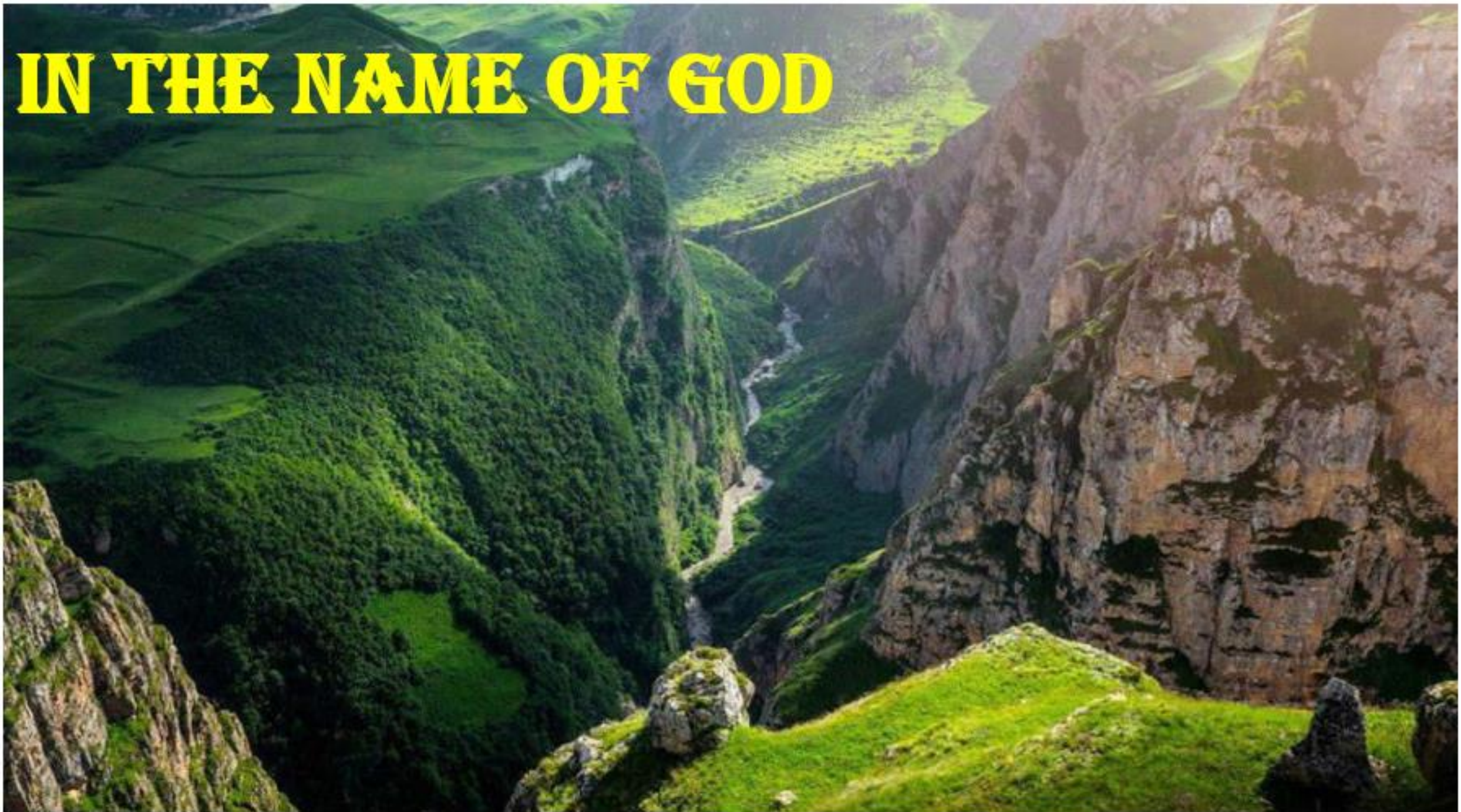


IN THE NAME OF GOD



New approaches in ergonomic design by using of nanotechnology



Introduction to Nanotechnology

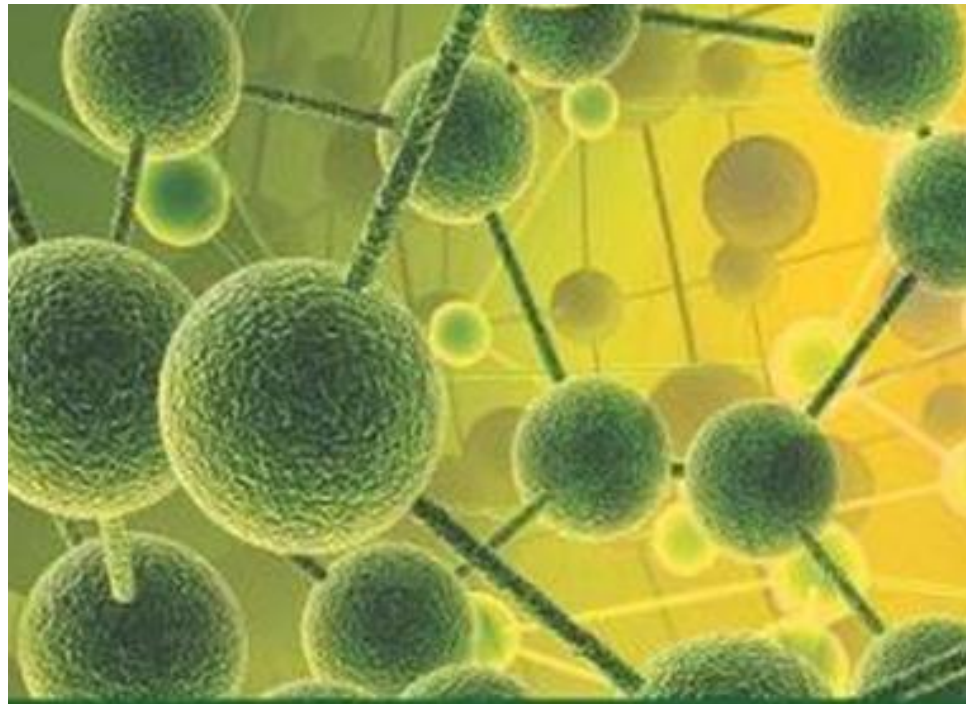
*Presenter;

Soqrat Omari Shekaftik

Postgraduate in Occupational Health Engineering,
Iran University of Medical sciences.

Email address; Soqratamary@gmail.com





Introduction to nanotechnology

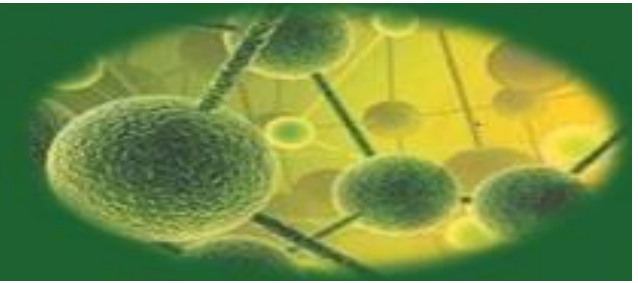
**In this section,
We will state that...**

- **A brief history of Nanotechnology**
- **The most important definitions**
- **Unique properties of nanomaterials**
- **Different types of nanomaterials**
- **Methods of fabrication**
- **Where are we?**
- **Standardization**
- **Challenges**



Nanotechnology

A brief history



- **1959**
- **Annual meeting of the American Physical Society**
- **Richard Feynman**
- **“There’s plenty of room at the bottom”**



Richard Feynman

- **1974**
- **Norio Taniguchi**
- **In reference to machining and finishing dimensional tolerances for semiconductor processes**
- **The development of the scanning tunneling microscope in 1981**



Norio Taniguchi

➤ A Study Committee for Nanotechnology in Iran began its activities in 2001.



Nanotechnology

The most important definitions



- **Nanotechnology**

Application of scientific knowledge to synthesis, manipulate and control nanomaterials

- **Nanomaterials**

Materials with any external dimension in the nanoscale or having internal structure or surface structure in the nanoscale

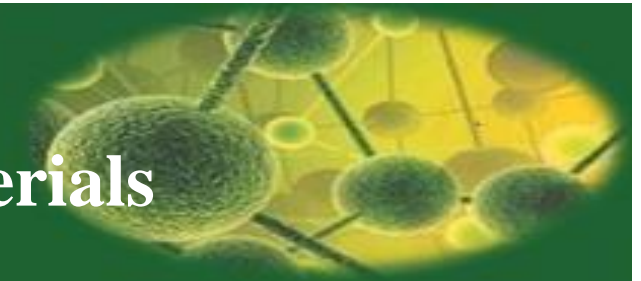
- **Nanoscale**

Size range from approximately 1 nm to 100 nm



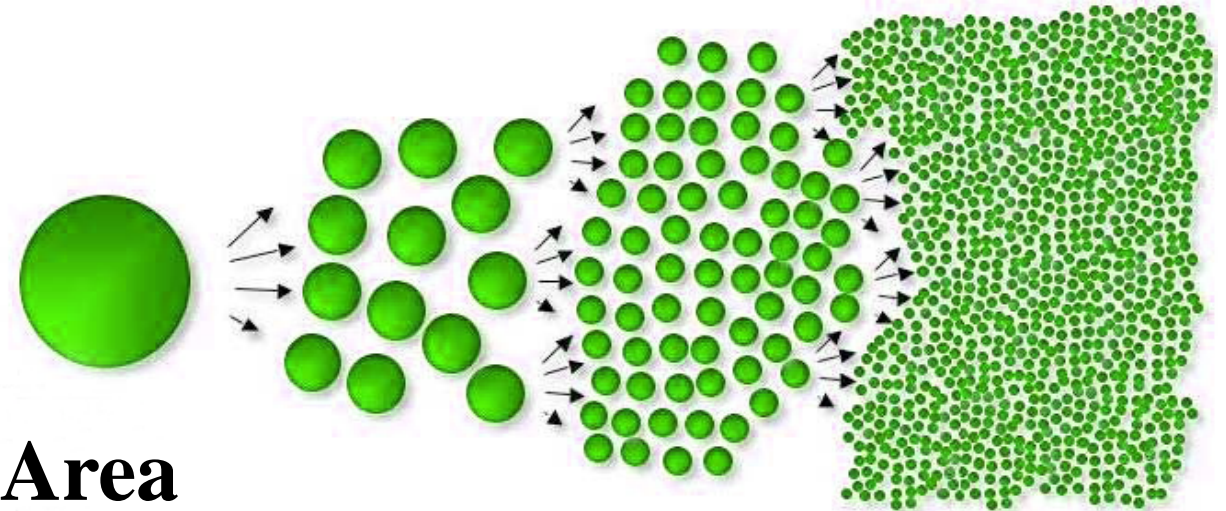
Nanotechnology

Unique properties of nanomaterials



- **Extremely** small **size**

- **Extremely Large** Surface Area

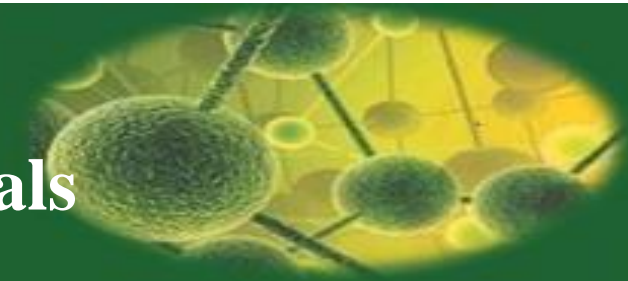


- The consequences of the nanoscale size and surface effects can be observed on the optical, electrical, mechanical, chemical, physicochemical, thermal, and magnetic properties of nanomaterials

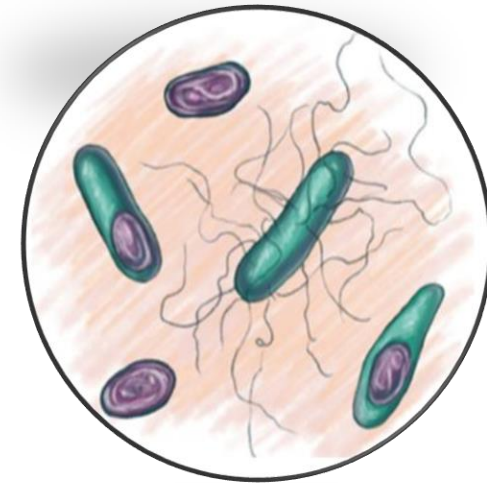
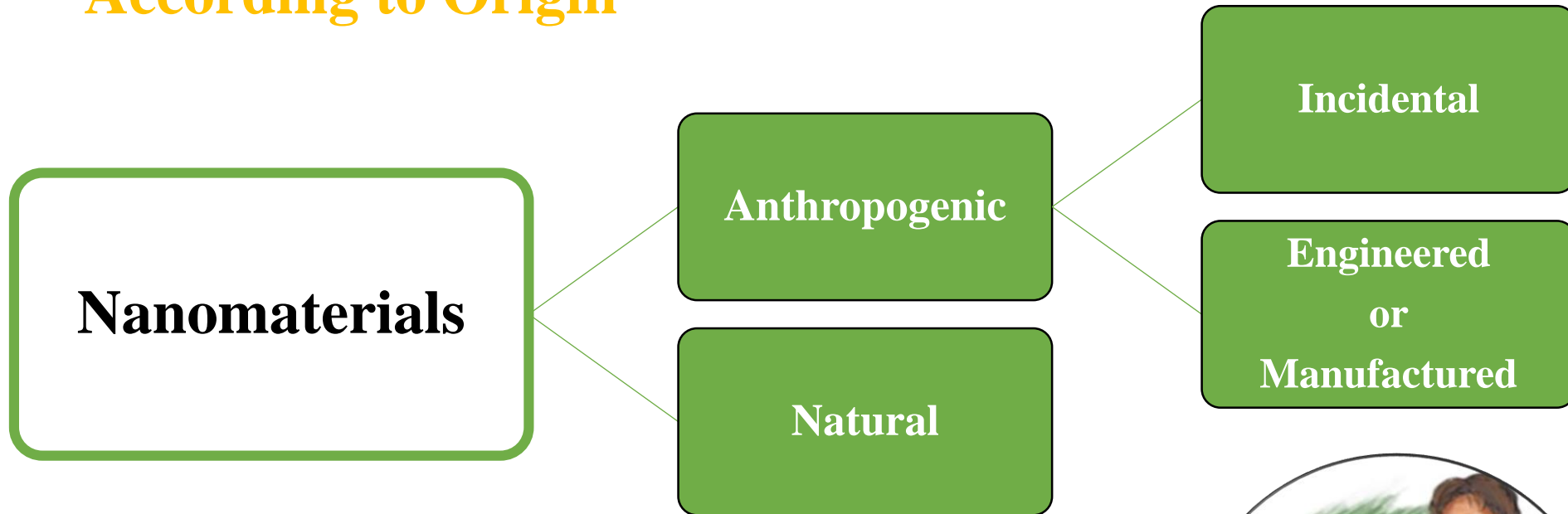


Nanotechnology

Different types of nanomaterials

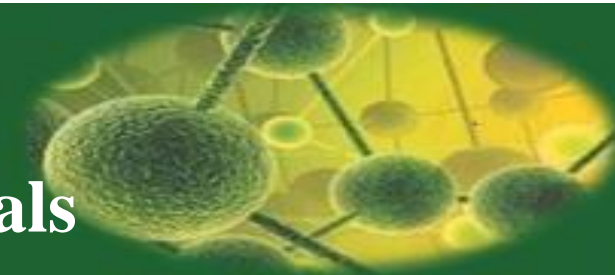


- According to Origin



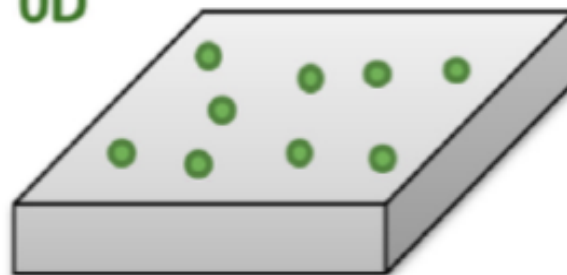
Nanotechnology

Different types of nanomaterials



- According to Dimensionality

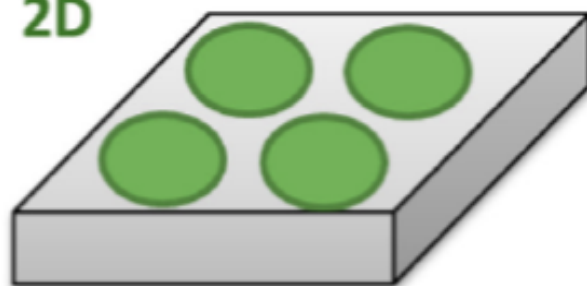
0D



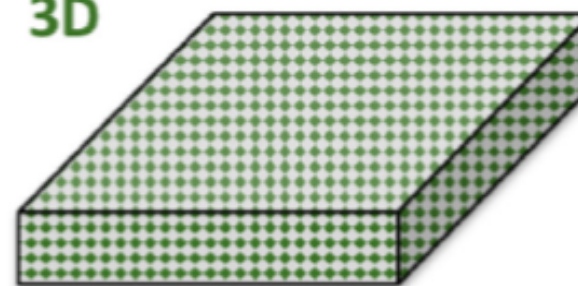
1D



2D



3D

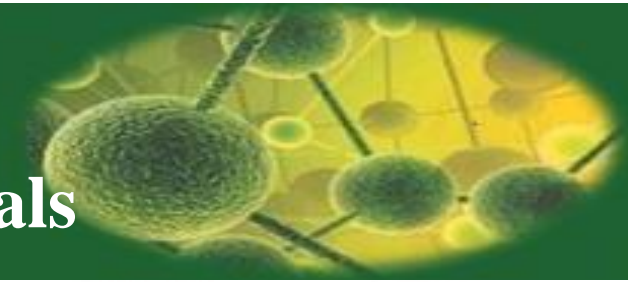


Dimensionality-based classification of nanomaterials.



Nanotechnology

Different types of nanomaterials



- According to Chemical Composition

Nanomaterials

Metals & Metal Alloys

Metal Oxides

Carbon-Based

Semiconductors

Silicates, Carbonates, & Nitrides

Polymers



micelles



dendrimers



quantum dots



core shell



polymeric micelles



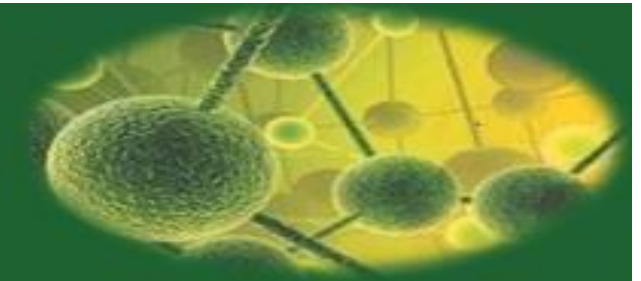
iron oxide

- According to Potential Toxicity



Nanotechnology

Methods of fabrication

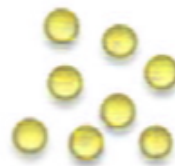


**Top-down
approach**



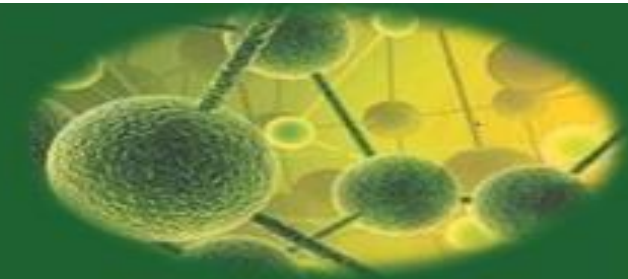
**Bottom-to-
bottom
approach**

**Bottom-up
approach**



Nanotechnology


Where are we?













NANOTECHNOLOGY PATENTS

GOVERNMENT INVESTMENT

1	 India
2	 Japan
3	 Malaysia
4	 New Zealand
5	 South Korea
6	 Taiwan
7	 USA

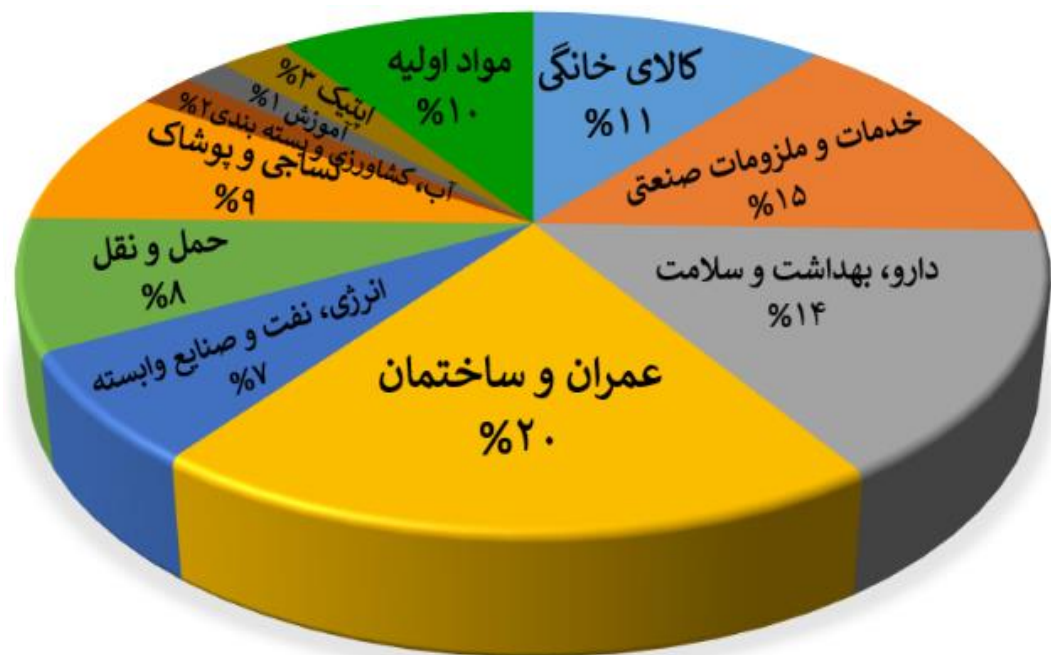
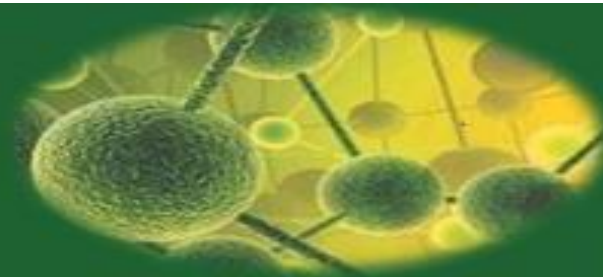
1	 USA
2	 Germany
3	 France
4	 South Korea
5	 Japan
6	 China
7	 Switzerland
8	 UK
9	 Italy
10	 Netherlands
43	 Iran

NANOTECHNOLOGY PUBLICATIONS

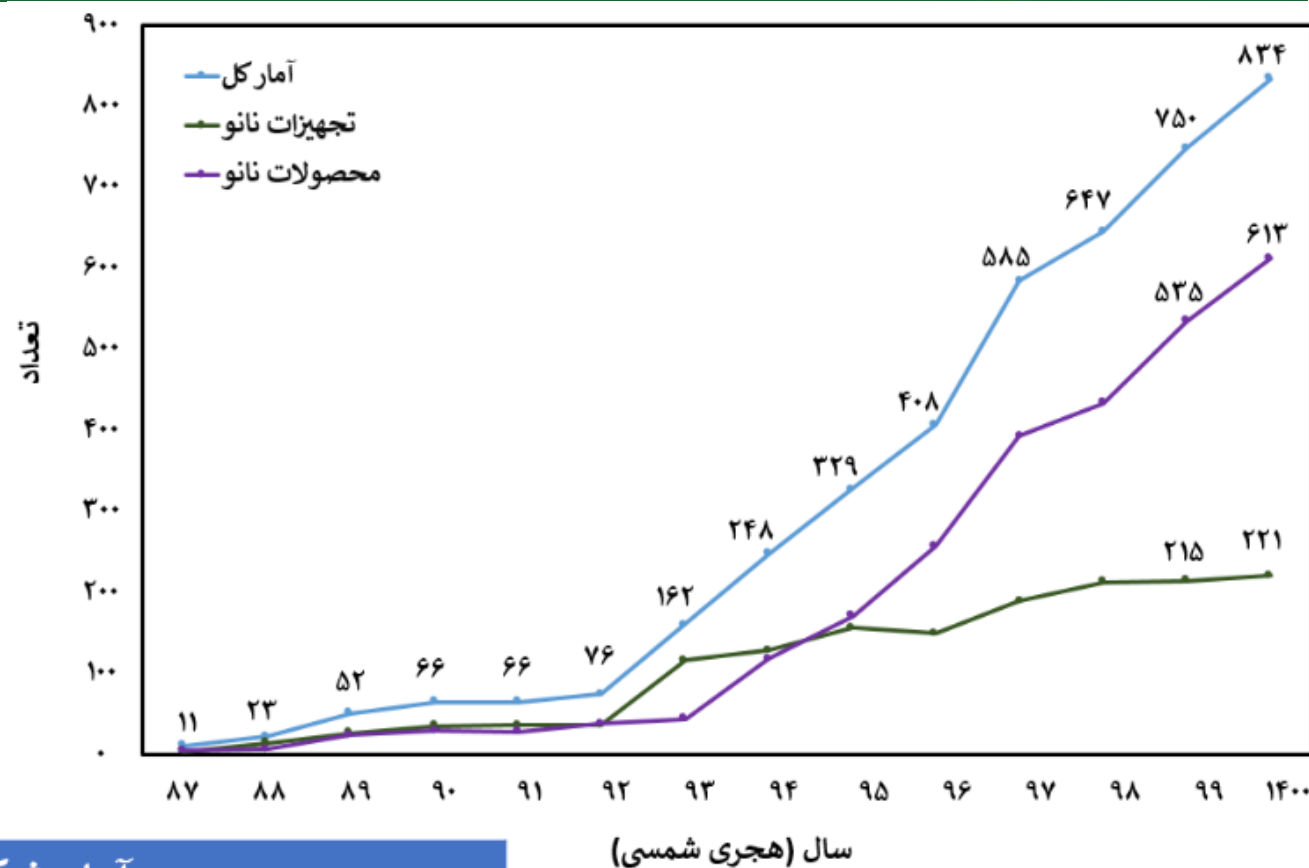
1	 China
2	 India
3	 USA
4	 Iran
5	 South Korea
6	 Saudi Arabia
7	 Japan
8	 Germany
9	 UK
10	 Australia



Nanotechnology Where are we?



حوزه کاربرد محصولات دارای گواهینامه نانومقیاس



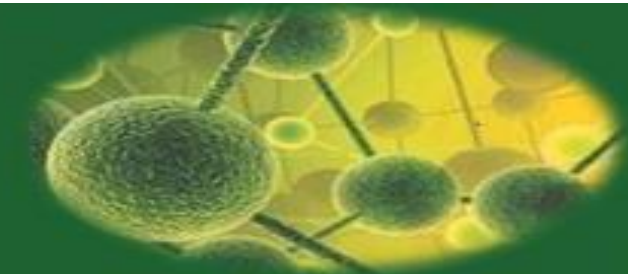
آمار شرکت ها

تعداد شرکت های تولید کننده محصول: ۲۶۰

تعداد شرکت های تولید کننده تجهیز: ۶۱



Nanotechnology Standardization



NATIONAL NANOTECHNOLOGY STANDARDS

	^	2016 ↕	2017 ↕	2018 ↕	2019 ↕	2020 ↕	2021 [June] ▼
1	China	129	156	180	190	203	203
2	UK	51	66	85	112	134	163
3	Iran	48	71	92	103	116	123
4	Netherlands	56	68	82	107	116	123
5	USA	69	74	75	85	118	123
6	Denmark	41	51	63	80	98	116
7	Sweden	43	44	53	71	77	84
8	Russia	34	41	58	62	67	74
9	France	23	32	36	54	65	72
10	Taiwan	69	69	69	69	69	69



Nanotechnology Challenges

✓ Fake applications

✓ Health &

✓ Safety &

✓ Environmental Issues



Nanotechnology in Ergonomics

*Presenter;

Nafiseh Nasirzadeh

PhD student of Occupational Health Engineering,
Tehran University of Medical sciences.

Email address; Nafisenasirzade@yahoo.com



Nanotechnology in ergonomic designs

**In this section,
We will state that...**



- What is Nano-Ergonomics?
- History of Nano-Ergonomics.
- Importance and necessity of using nanotechnology in ergonomics.
- Applications of Nanomaterials in the field of design ergonomics.

Physical ergonomics
Environmental ergonomics
Cognitive ergonomics

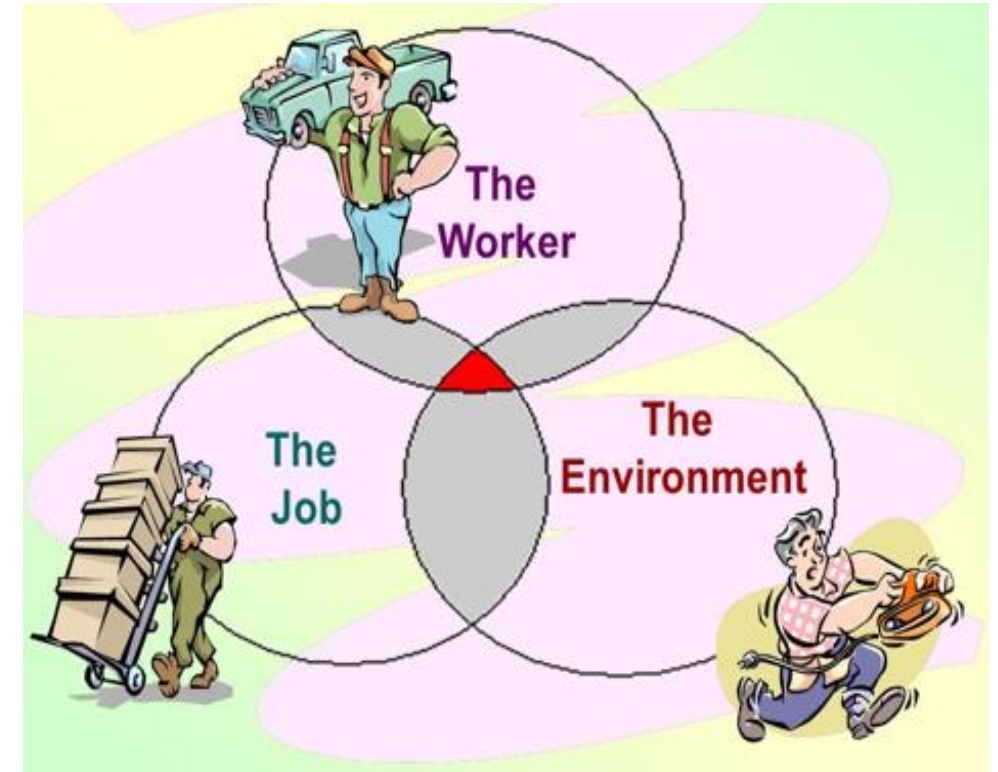
Technological Singularity



What is Nano-Ergonomics?



- Human factors and **ergonomics** (commonly referred to as human factors) is the application of psychological and physiological principles to the engineering and design of products, processes, and systems.
- If **design** is considered as ‘lock’, **ergonomics** would be its ‘key’.
- Nowadays, nanotechnology is well-known terms to **designers**.



History, Importance & Necessity of using of Nano-Ergonomics



- Karwowski (2005) first introduced a new term ‘Nano-ergonomics’ which has been generated by fusion of two subjects; ergonomics and nanotechnology.
- Nano-ergonomics may involve employment of nanomaterials to fit the jobs to human.
- Nano-ergonomics can help to develop a more comfortable environmental condition in the workplace based on ergonomic design principles.



Applications of nanomaterials in the field of ergonomics



- Electronic
- Catalytic
- Agriculture
- Medical science
- Other....



Applications of nanomaterials in the field of physical ergonomics



➤ Product Design & Manufacturing

- ✓ Chair design
- ✓ Computer Parts & Components
- ✓ Food packaging containers
- ✓ Personal protective equipment (PPE) such as;



- ✓ Protective earphones and human hearing system
- ✓ Respiratory Protective Equipment
- ✓ Heat Protective Equipment
- ✓ Radiation Protective Equipment
- ✓ And etc.



Examples



HON Prominent High Back Task Mesh Computer Chair with Arms for Office Desk, Black (HVL532), Asynchronous Control

[Visit the HON Store](#)

★★★★☆ 400 ratings

Size: **Asynchronous Control**

Asynchronous Control

Swivel-Tilt

Style Name: **Fabric**

Leather

Fabric

Full Mesh

Design: **Office Chair**

Color Black

Material Textile

Item Dimensions 26 x 30.75 x 44.5 inches

LxWxH

Furniture Finish Black

Maximum 250 Pounds

Weight

Recommendation

Roll over image to zoom in



VIDEO

Nano-ergonomic Chair



Mini Nano Stapler, Staples 12 Sheets, Assorted

Brand: **Accentra**

★★★★☆ 15 ratings | 5 answered questions

Price: **\$8.99**

Brand Accentra

Color Assorted

Item Dimensions 5.4 x 3.9 x 1.25 inches

LxWxH

About this item

- SOLD AS 1/BX.
- With One-Finger™ spring-powered technology, staple with an easy squeeze.
- Smooth, jam-free stapling operation.
- Mini size for convenient, on-the-go use.

[Compare with similar items](#)

New (2) from **\$3.28**

amazonbasics

Save on Quality Copy Papers

Shop now



Computer Equipment



Roll over image to zoom in

axGear Wireless Gaming Mouse Cordless Optical Mice 6 Keys USB Nano Receiver Ergonomics

Brand: axGear

★★★★☆ 2 ratings

Currently unavailable.

We don't know when or if this item will be back in stock.

Movement Detection Technology Optical

Brand AxGear


Hand Orientation Ambidextrous

Hardware Platform PC

Batteries Required? No

About this item

- Ergonomics design, suitable for left or right hands
- 6 keys, more convenient for game or shortcut operations
- Resolution frequency(500-1600DPI) conversion
- Quieter and Easier to click, make you concentrate on your work without disturbing others beside you



2 VIDEOS

Roll over image to zoom in

ViewSonic ELITE XG270QG 27 Inch 1ms 1440p 144hz (165Hz OC) GSYNC Gaming Monitor with IPS Nano Color Elite Design Enhancements and Advanced Ergonomics for Esports

Visit the ViewSonic Store

★★★★☆ 1,217 ratings

114 answered questions

Amazon's Choice for "viewsonic elite xg270qg"

Price: **\$594.61**

Style: **27-Inch 144Hz**

24-Inch 144Hz 7 options from \$336.97	27-Inch 144Hz \$594.61
27-Inch 165Hz \$479.99	27-Inch 240Hz \$414.95
27-Inch Curved 165Hz \$449.99	

Screen Size 27 Inches

Resolution QHD Wide 1440p

Display Technology LCD



Design of food packages is a challenging for ergonomist;

Size
Shape
Color
Visual graphics



Problems



Many foods are less weighted, spoiled and/discolored due to environmental exposure.



Nanoergonomics play a vital role in food packaging such as TiO_2 , ZnO , Ag_2O_3 , ...



PPE

- The **textile industry** is one of the major industrial sector utilizing the growth of nanotechnology.
- **Nanotex**, a subsidiary of the US-based Burlington Industries, pioneered the commercial application of nanotechnology in textiles.
- The textiles are used in manufacturing of many PPEs; Such as masks, gloves,....



Respilon Group Incorporates into Nanofibers in a mask.

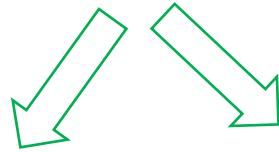
The company is recently working on the project with an Israeli partner, who has the patent to make the copper dioxide (CuO) nanoparticles that are present in the fibers.

Mask can Traps and Kills viruses including **Coronavirus**.
(2021)



Ergonomics researchers are now trying to overcome **heat stress problem**

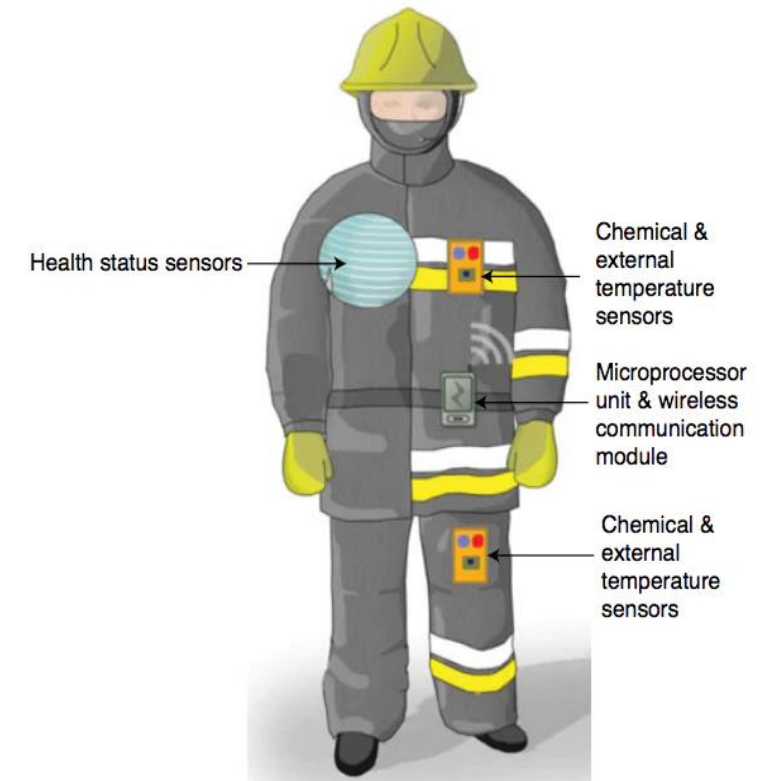
Example



Protective clothes for **firefighters**

Sensors used in smartphone to help firefighters monitor air quality around fires

MnO nanoparticles



The **metal oxide NPs** are mostly used for **textile** functionalization as antibacterial, antistatic, ultraviolet **(UV) protection** and self-cleaning agents.



Farmer jobs, Welding arcs, Landscapers, Laboratory and Medical jobs and Swimmers....



Applications of Nanomaterials in the field of environmental ergonomics



➤ **Environmental ergonomics** studies the interaction of people with their physical environment such as Climate (comfort, thermal stress and clothing), Light (physiological eye function and impact of lighting parameters), vibration, noise,....



➤ The unique properties of nanomaterials enable the novel technologies for meeting the environmental challenges in a sustainable way.



Examples

Nano soundproof panel For Perfect Sound Control

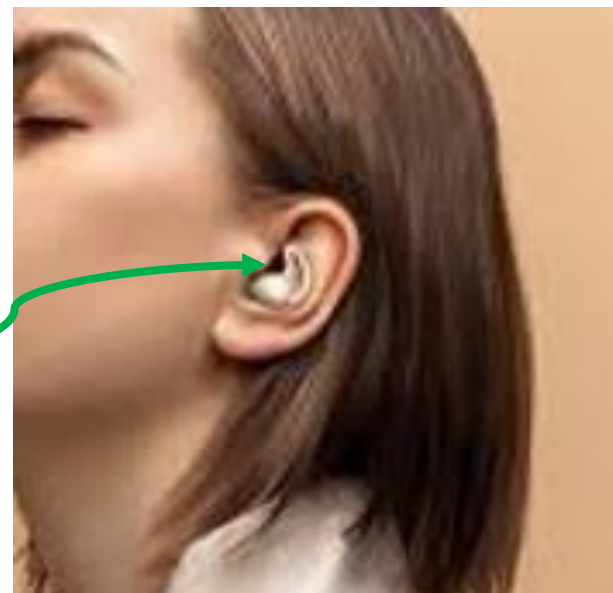
Hospital

Office

Industry

According to sound frequency, in environment, many different nanomaterials are used to sound control; Such as CNT, Silica, Metal nanoparticles,...

Nano silica earplugs



Nanotech LED Lighting

- Lighting has been an important aspect of our lives, of our existence.
- The LED quantum dots will firstly be used for TV and notebook displays to offer consumer a wider range of colors.



Nanoleaf Light Panels

- In **Smart** Nano-Leaf, change of color happens automatically and spontaneously round the clock based on environmental conditions and in addition to lighting the place using a set of special and suitable colors, can affect the person psychologically.



Smart Glass → Integrating electro-chromatic glass with ultra-thin nano-coating



Strong light absorption & prevents of solar radiation from the window into the workstation



It play a vital role in **Cognitive aspects** of human-computer interactions



Design for Manufacturing (DFM)

CHALLENGES

- A way that they are easy to manufacture.
- Facilitate the manufacturing process in order to reduce its manufacturing costs.



Applications of Nanomaterials in the field of cognitive ergonomics



- **Cognitive ergonomics** is the field of study that focuses on how well the use of a product matches the cognitive capabilities of users. It draws on knowledge of human perception, mental processing, and memory.
- Freud had hoped to base psychology on the understanding of neural events inside the brain. However, techniques for studying the brain at the physiological level were limited, and there is still a long way to go to simulate brain activity at the neuron level.
- Advancements in this area would help us understand the functioning of the brain.



“**NanoNeuro**” was firstly used in the journal Nature Methods ! (2021)

- NanoNeuro as the application of nanomaterials-nanoprobes and nanoelectrodes to neuroscience. These nanomaterials will help us investigate neural circuitry at incredibly small scales.

nature methods

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Perspective | [Published: 18 October 2021](#)

Time for NanoNeuro

[Aitzol Garcia-Etxarri](#) ✉ & [Rafael Yuste](#) ✉

[Nature Methods](#) **18**, 1287–1293 (2021) | [Cite this article](#)

3257 Accesses | **1** Citations | **43** Altmetric | [Metrics](#)

Nanotechnology offers the possibility of **probing neural activity** at the sub-cellular level, significantly improving our understanding of critical brain functions.



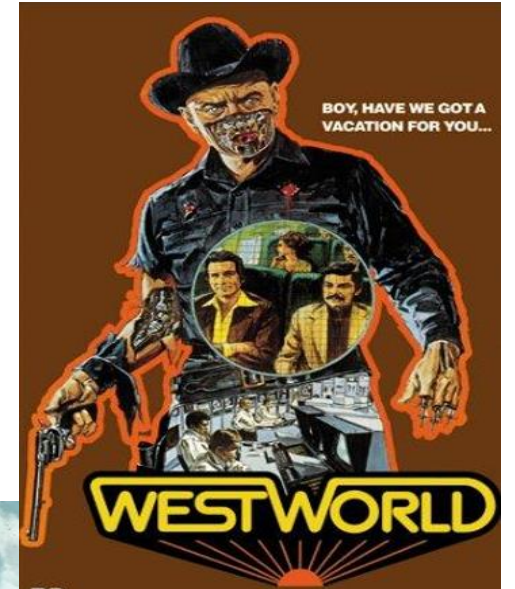
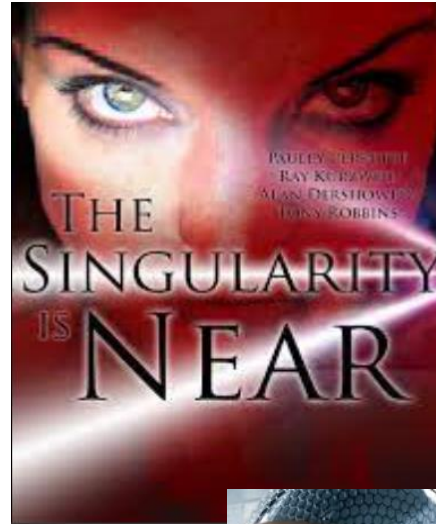
Example

With the help of nanotechnology brain science proposes to go further: to study its molecular foundations, to repair brain functions, to create mind-machine interfaces, and to enhance human mental capacities in radical ways.

Quantum dots are nanoparticles that fluoresce under an electric field. This **fluorescence** can be modulated with the strength of the electric field and reveal the activities of individual neurons. They could replace fluorescent dyes currently used in **medical imaging**.



The technological singularity and the future of humanity challenges!!!!



Technological Singularity



- The technology optimist view, technological singularity as an advance future.
- Which in turn will eradicate many intricate problems that we face today.
- **Artificial intelligence** will be able to do almost all the cognitive tasks performed by humans.



1 The accelerating pace of change ...



2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

COMPUTER RANKINGS

By calculations per second per \$1,000



Analytical engine

Never fully built, Charles Babbage's invention was designed to solve computational and logical problems



Colossus

The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II



UNIVAC I

The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.



Apple II

At a price of \$1,298, the compact machine was one of the first massively popular personal computers

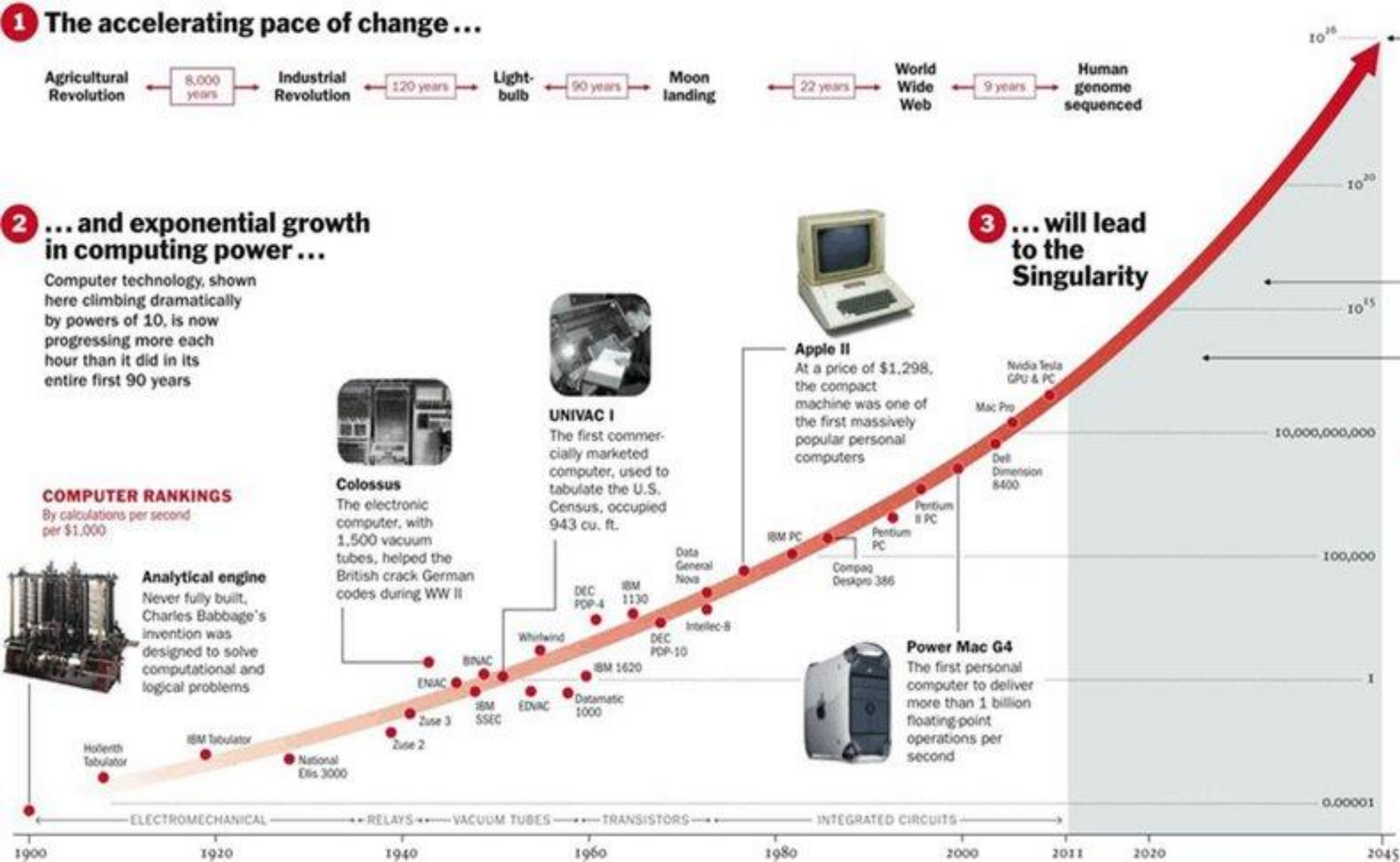
3 ... will lead to the Singularity



Surpasses brainpower of human in 2023



Surpasses brainpower of mouse in 2015



How can **AI** and **nanotechnology** come together and build the future of humanity's existence?

➤ **Nanotechnology** will be the tool that AI will use to achieve the singularity.

- Some of applications
- Nanobots
 - Nano-computer
 - Resolving the world's Food Problems

- Medical applications
- ✓ Minimal invasiveness
 - ✓ Manipulation of stem cells
 - ✓ Differentiating between good and bad cells, in cancer therapy





SUMMARY

- Nanotechnology & Basic
- Nano-Ergonomics & History
- Importance nanotechnology in ergonomics (design ergonomics)
- Technological Singularity
- Challenges
 - ✓ Toxicology
 - ✓ DFM
 - ✓ Technological singularity





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-



Do You Have Any Questions?



Thank
You!

