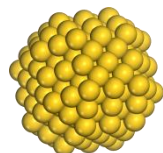


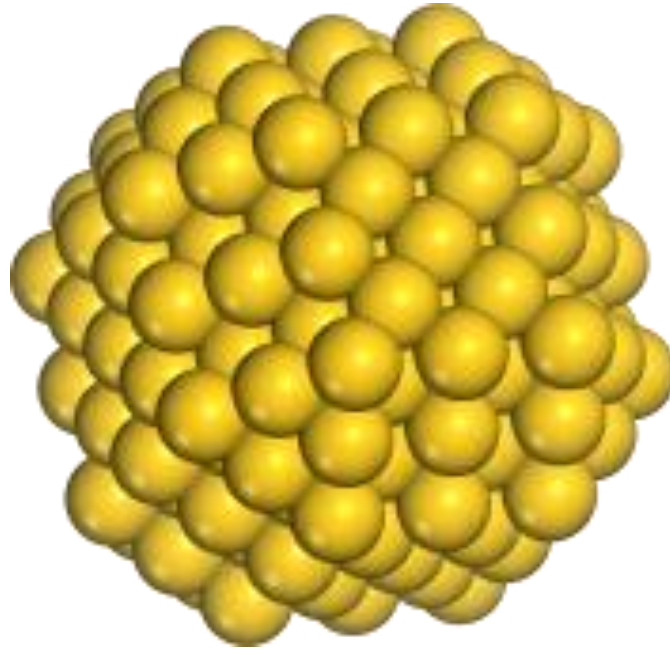
Nanoparticles



IoT Team of
Valahia University Of Targoviste
ROMANIA

What are nanoparticles?

solid isolated object

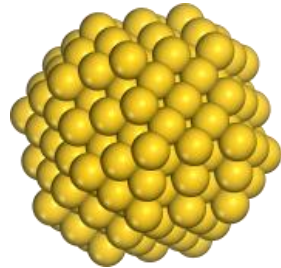


The size between 1 and 100 nm

with a well-defined margin with the environment

Dimension of nanoparticles

As mentioned, nanoparticles are sized between 1 and 100 nm. To understand how this means, we need to make a trip through known by us things to make a comparison.



Milky Way

Certainly, each of you has seen in the sky the Milky Way, the galaxy in which our sun enters. The diameter of this is so huge that we would need 100,000 years to go through, if we had the speed of light. This would mean about a quintillion kilometers!



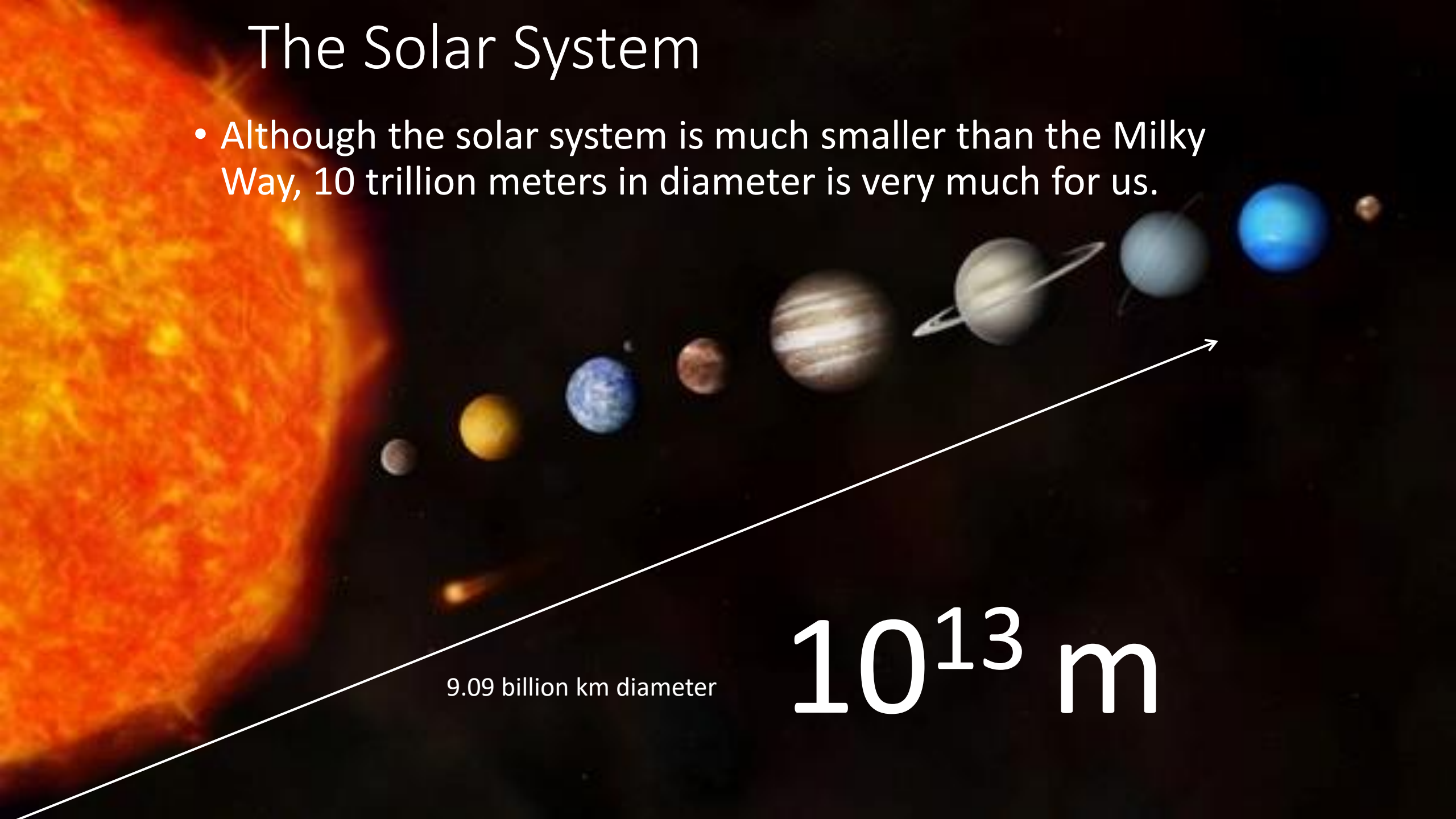
946,728,000,000,000,000 km

100,000 light years in diameter

10^{21} m

The Solar System

- Although the solar system is much smaller than the Milky Way, 10 trillion meters in diameter is very much for us.



9.09 billion km diameter

10^{13} m

Earth

It is possible that our planet seen from the Universe look like a nanoparticle. Earth's diameter is more than 10 million meters.

10^7 m



12,713.5 km diameter

Black Sea

The Black Sea, on the shore where we are,
has the length more than 1 million meters.

10^6 m

1,175 km



Eiffel Tower has a
length of several
hundred meters.

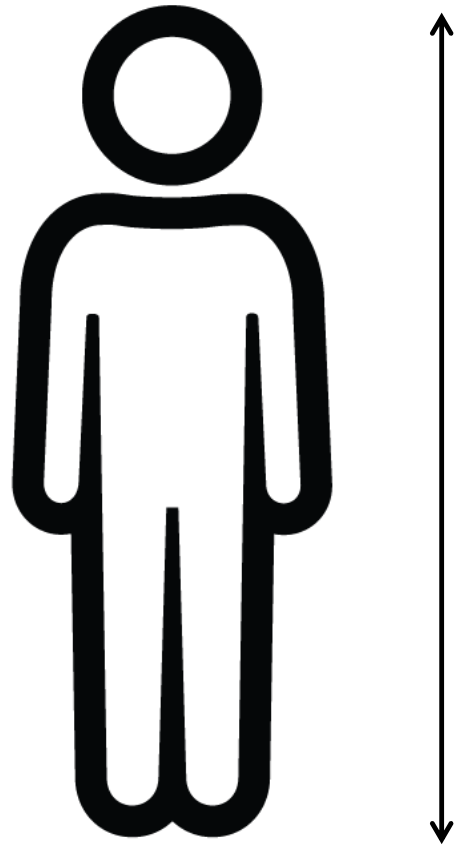
300 m

Tour Eiffel

10^2 m



Human body



1.75 m

10^0 m

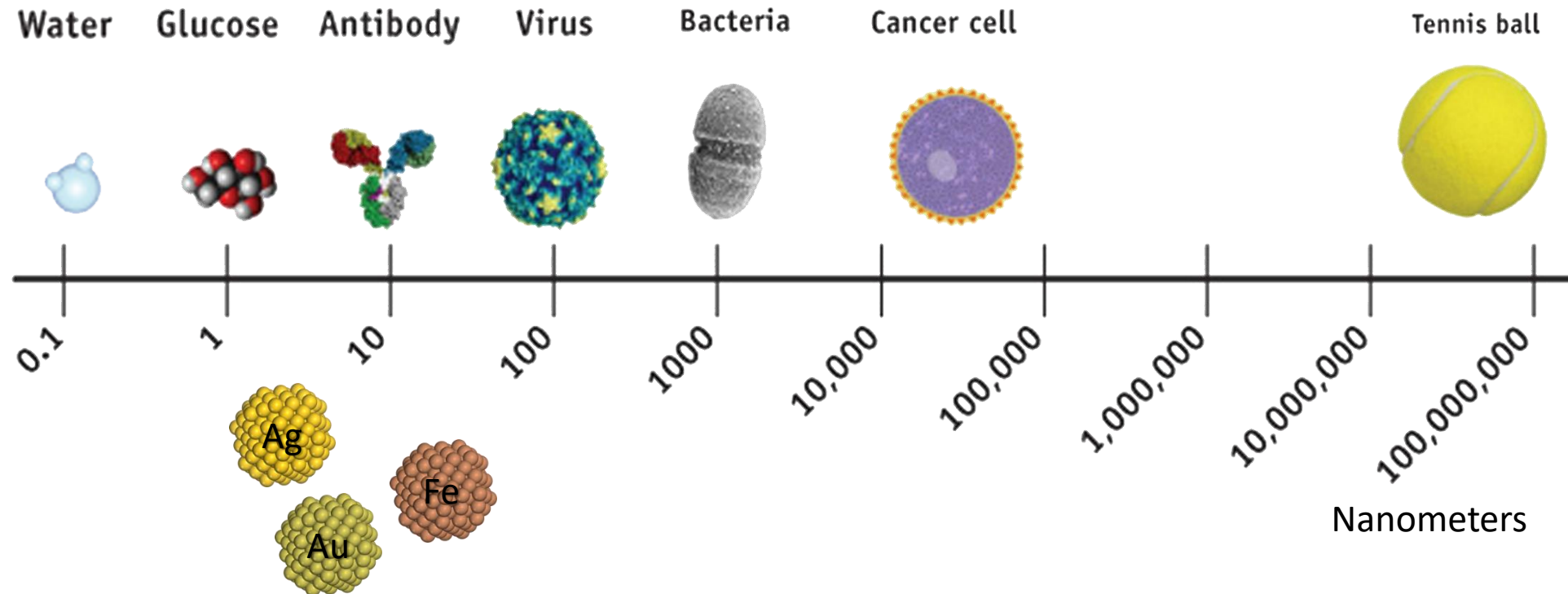
Human height varies between 1 m and 2 m

Dimension of nanoparticles

Getting down to smaller objects, we get to objects can not be seen with the naked eye. If the tennis ball has 10 cm, the nanoparticles have size 100 million times smaller!

$10^{-9} \text{ m} - 10^{-7} \text{ m}$

10^{-1} m

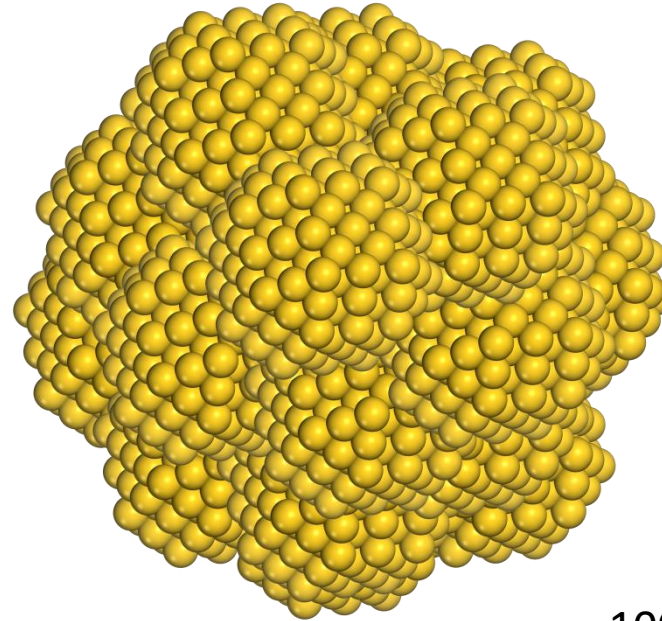
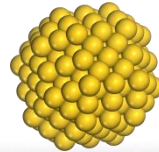


Classification of nanoparticles

Nanoparticles are classified into two categories: nanoclusters (with sizes between 1-5 nm, containing less 1000 atoms) and nanoparticles (with sizes between 5-100 nm, with 1000-100000000 atoms).

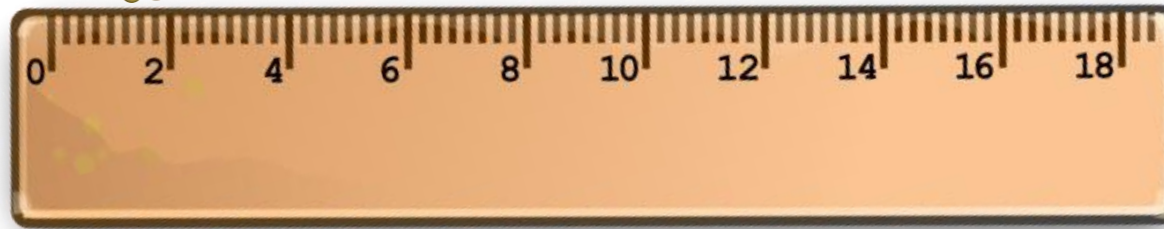
Nanoclusters

1 – 5 nm
1000 atoms



Nanoparticles

5 – 100 nm
1000 – 100000000 atoms





History of nanoparticles

Discoveries related to nanoparticles have a very interesting history.



Mesopotamia

The first evidence of the human use of nanoparticles are dated from **9 century B.C.**

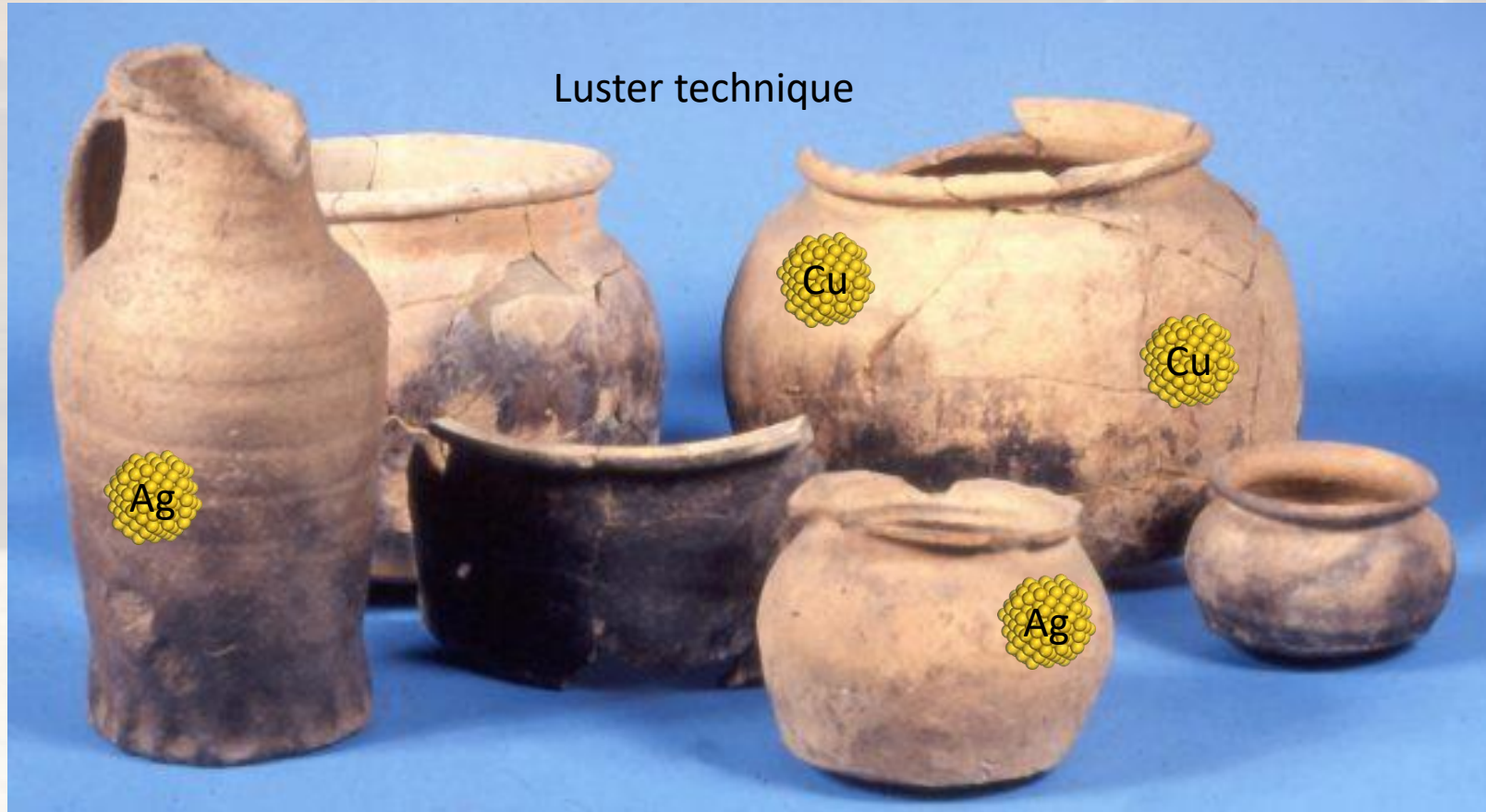


They were used for generating a glittering effect on the surface of pots

Europe

Middle Ages/ Renaissance (5th – 17th centuries)

application of copper and silver nanoparticles in the form of a film on ceramic vessels



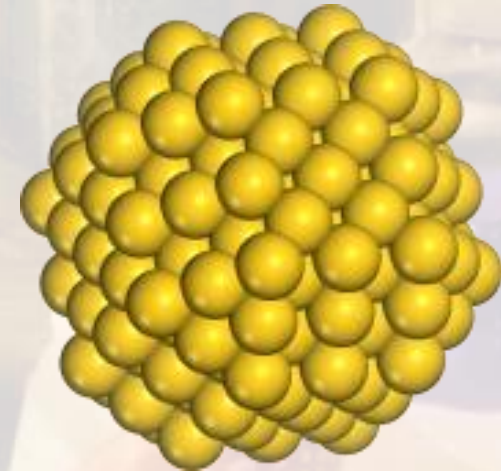
Great Britain

1857

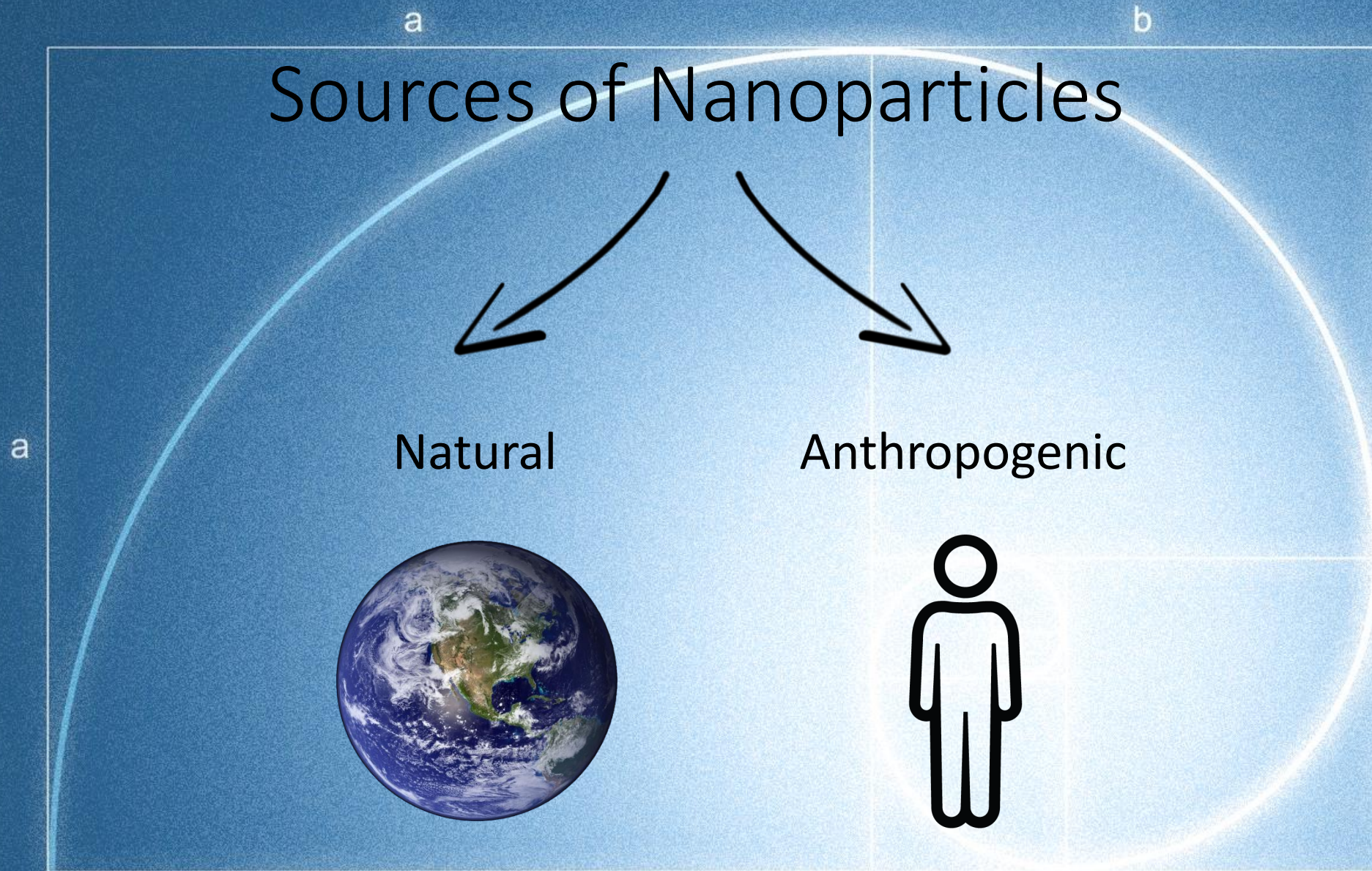


Michael Faraday

Explain scientifically optical properties of nanoparticles

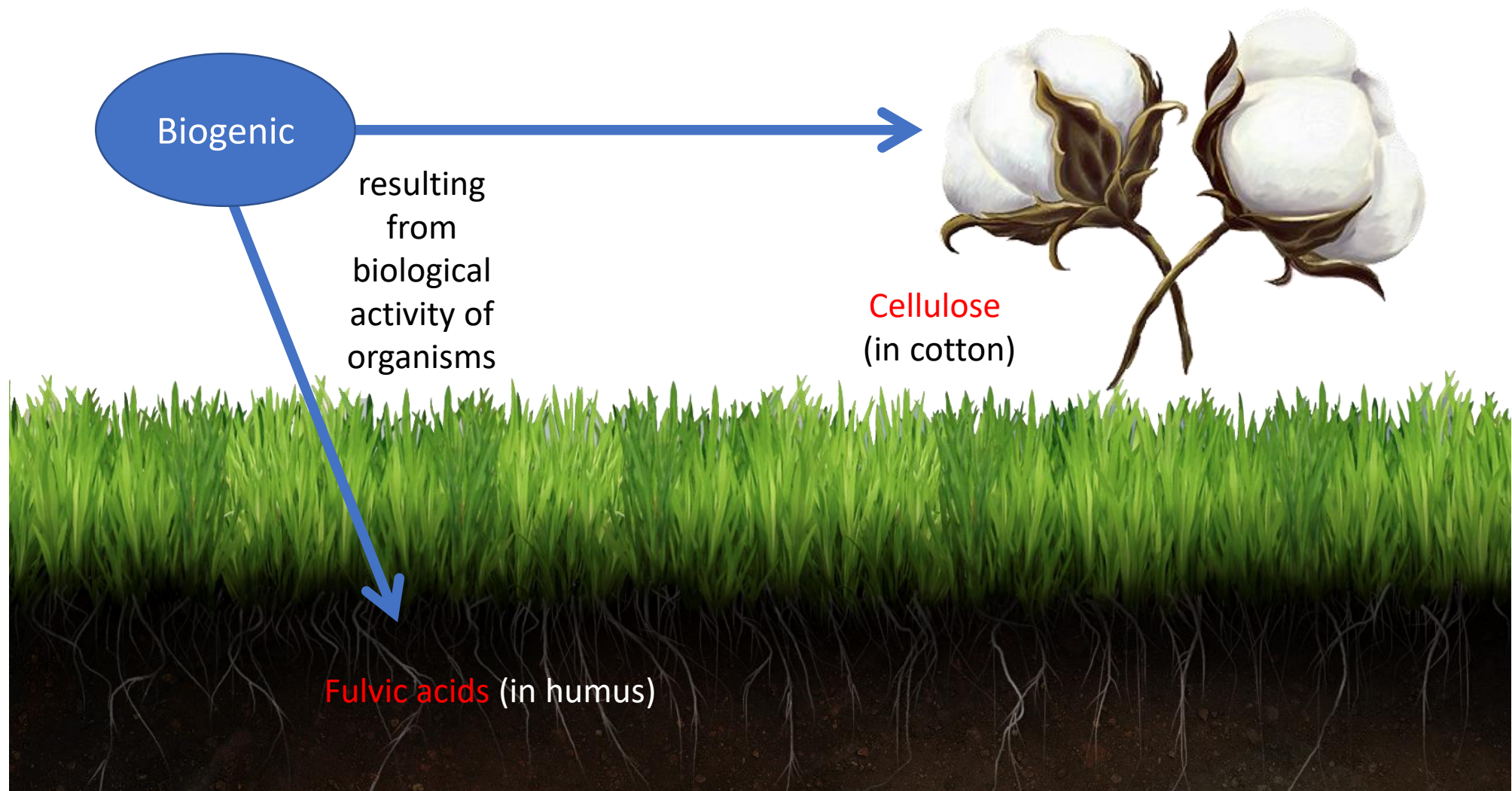


Sources of Nanoparticles

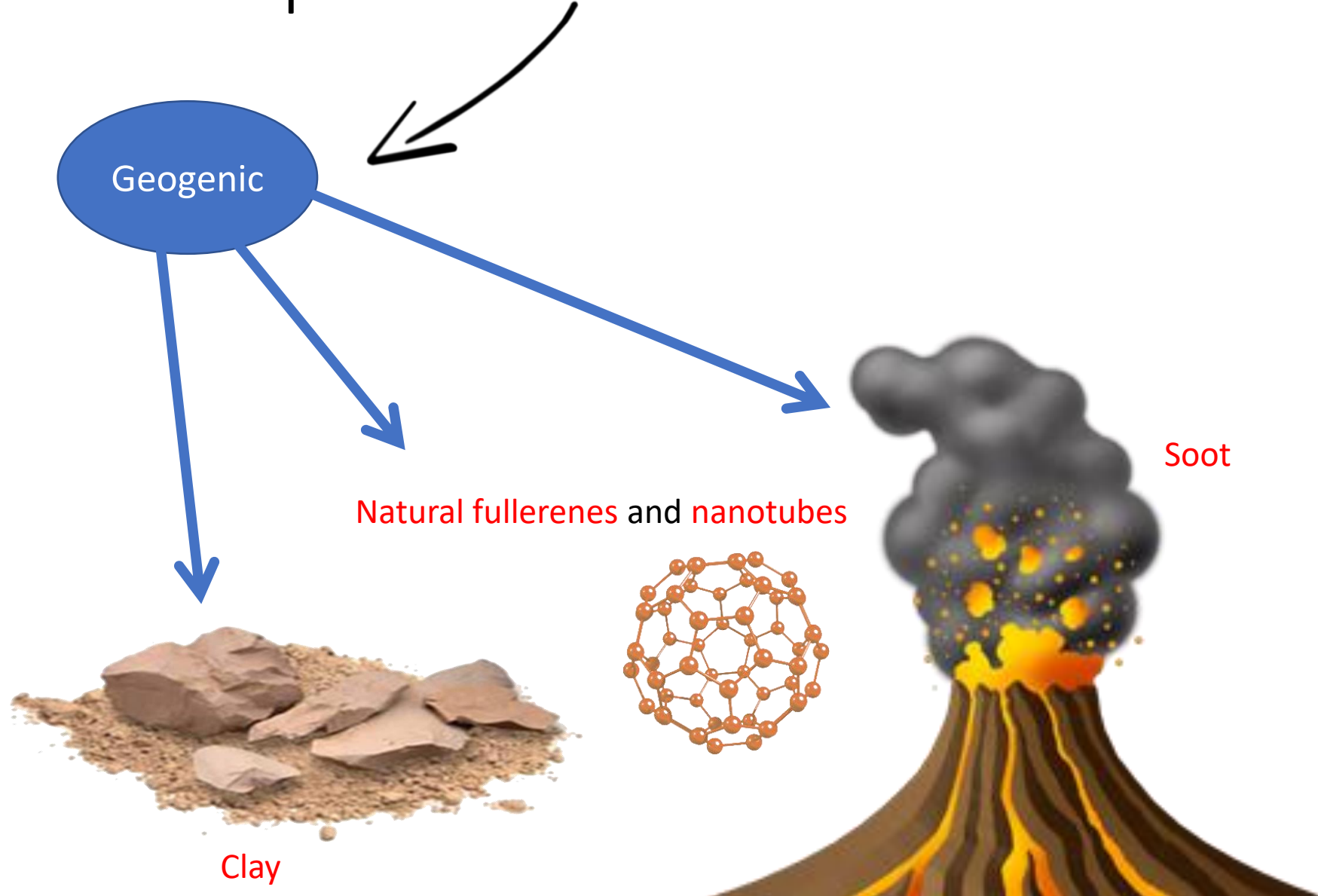


$$\frac{a+b}{a} = \frac{a}{b} = \varphi \approx 1,61803$$

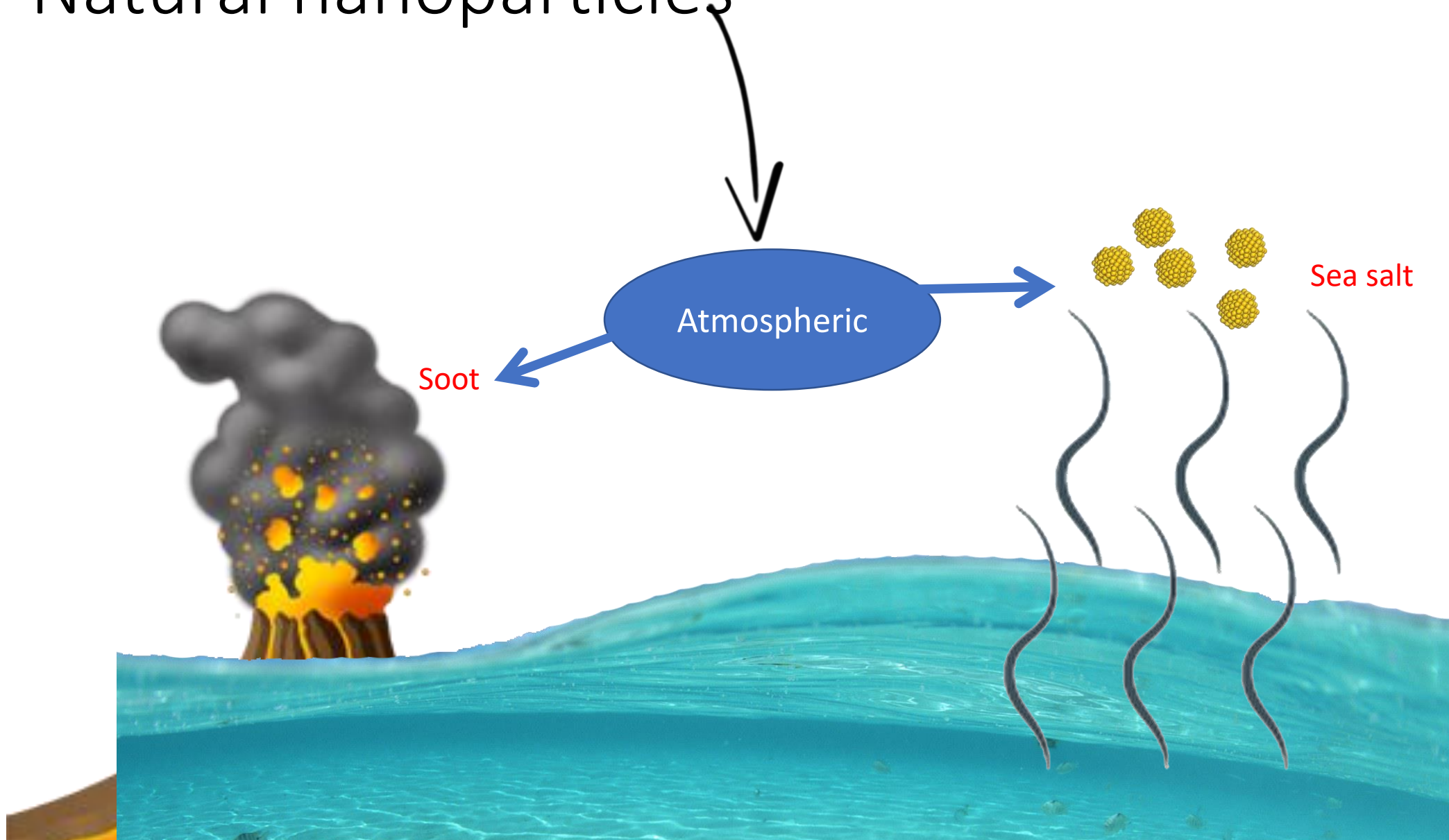
Natural Nanoparticles



Natural Nanoparticles

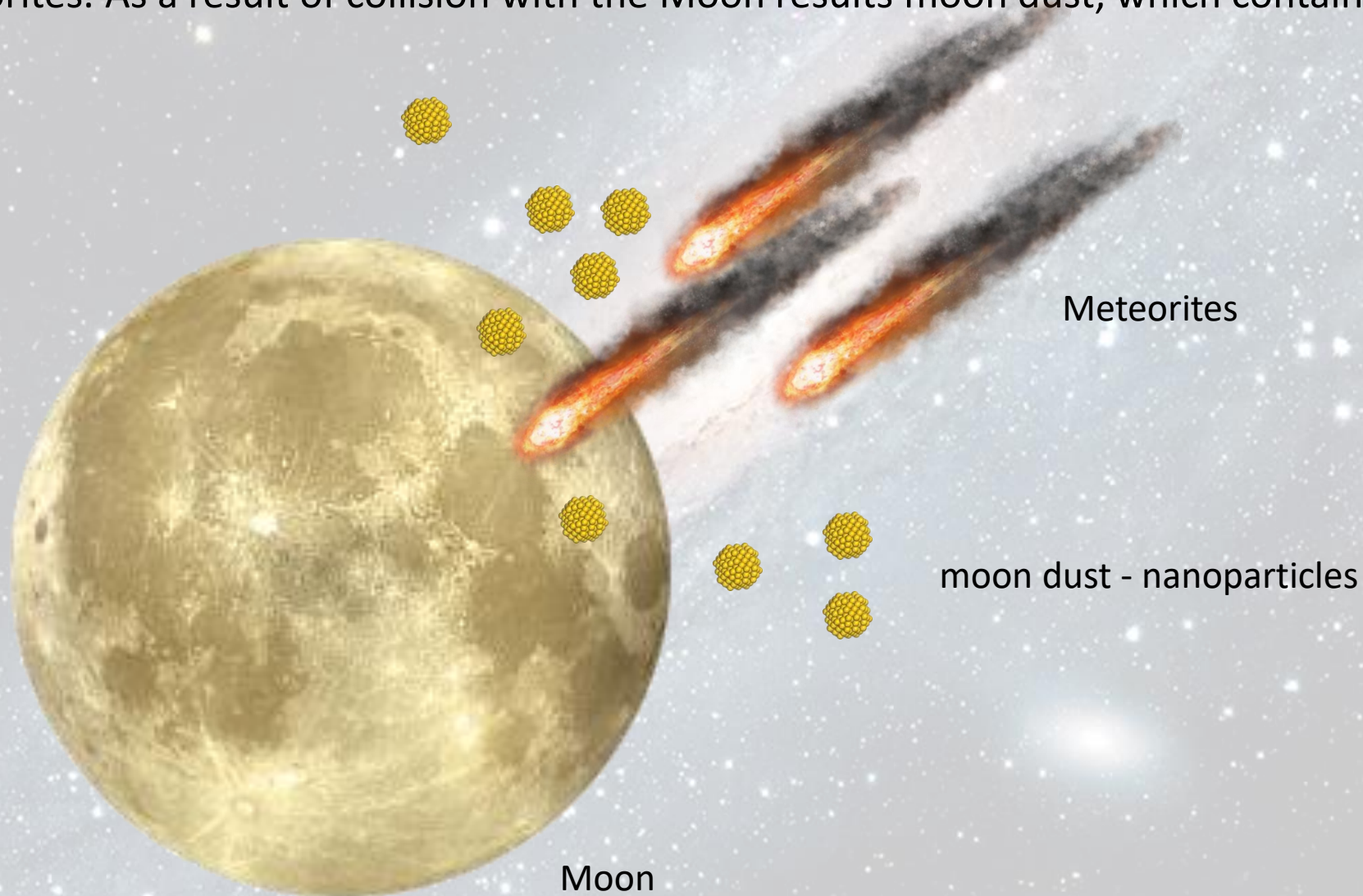


Natural nanoparticles

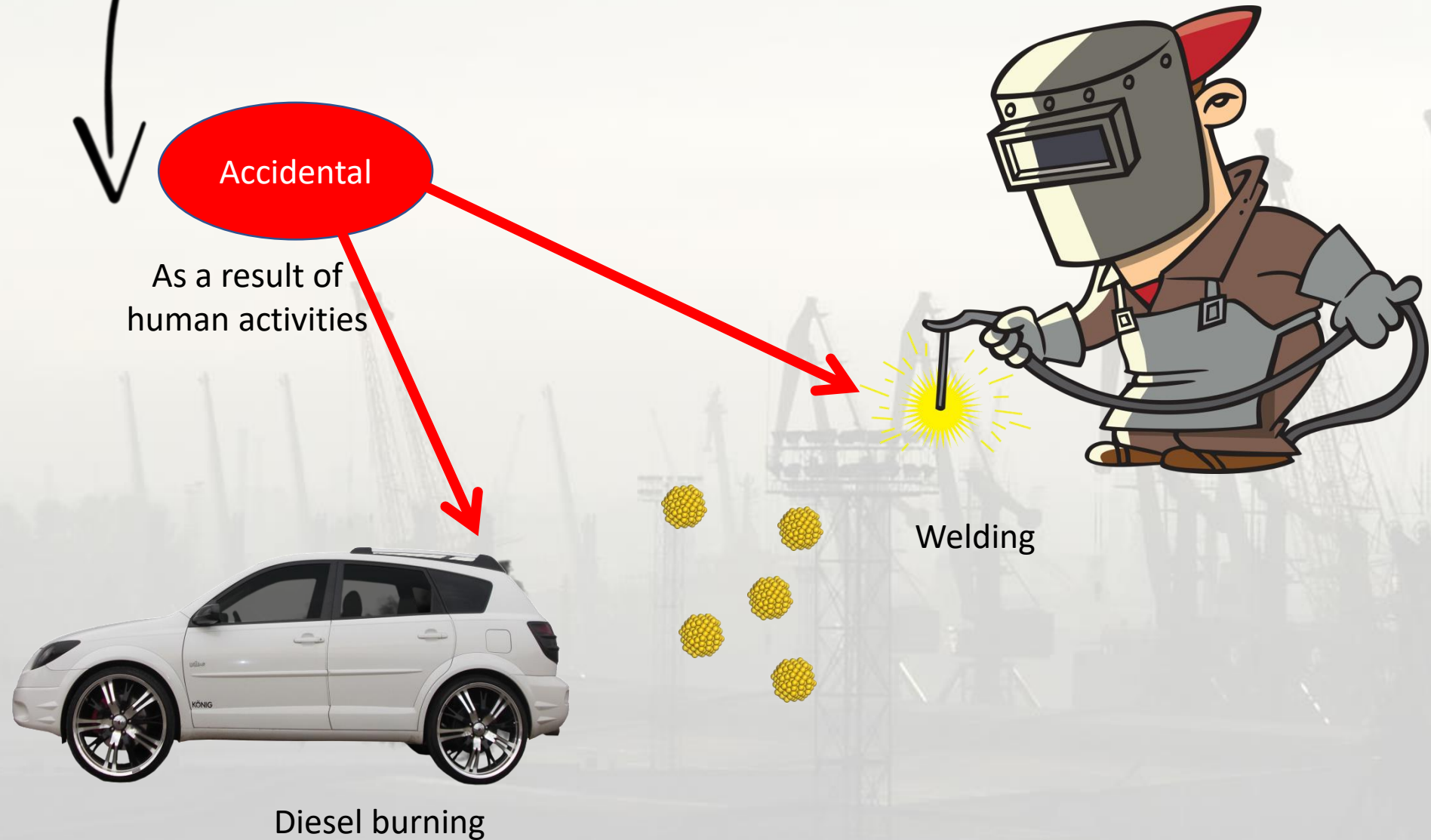


Nanoparticles in cosmos

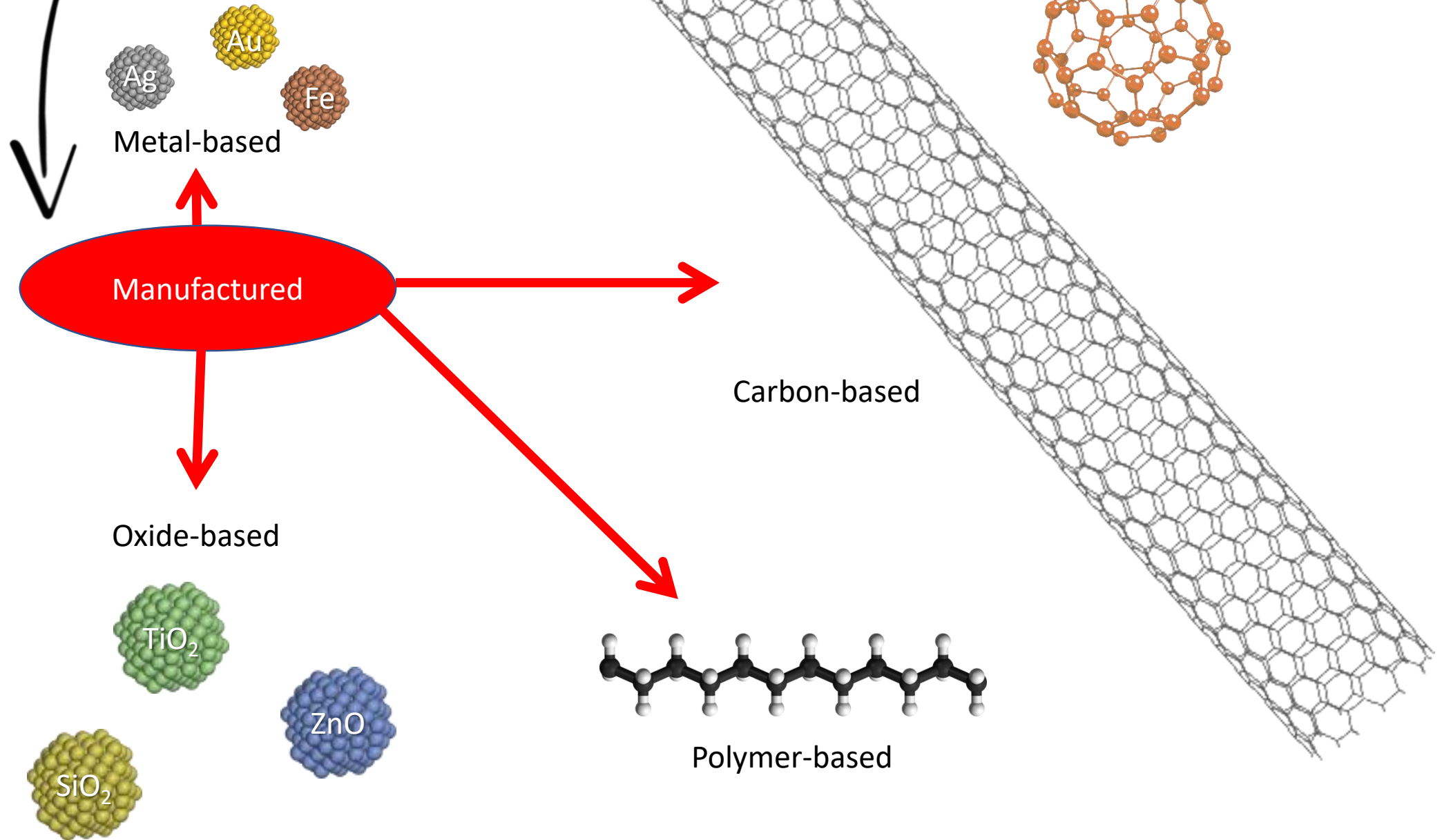
- Nanoparticles exist in the cosmos. A good example could be the moon, which is regularly bombarded by meteorites. As a result of collision with the Moon results moon dust, which contains many nanoparticles.



Anthropogenic nanoparticles

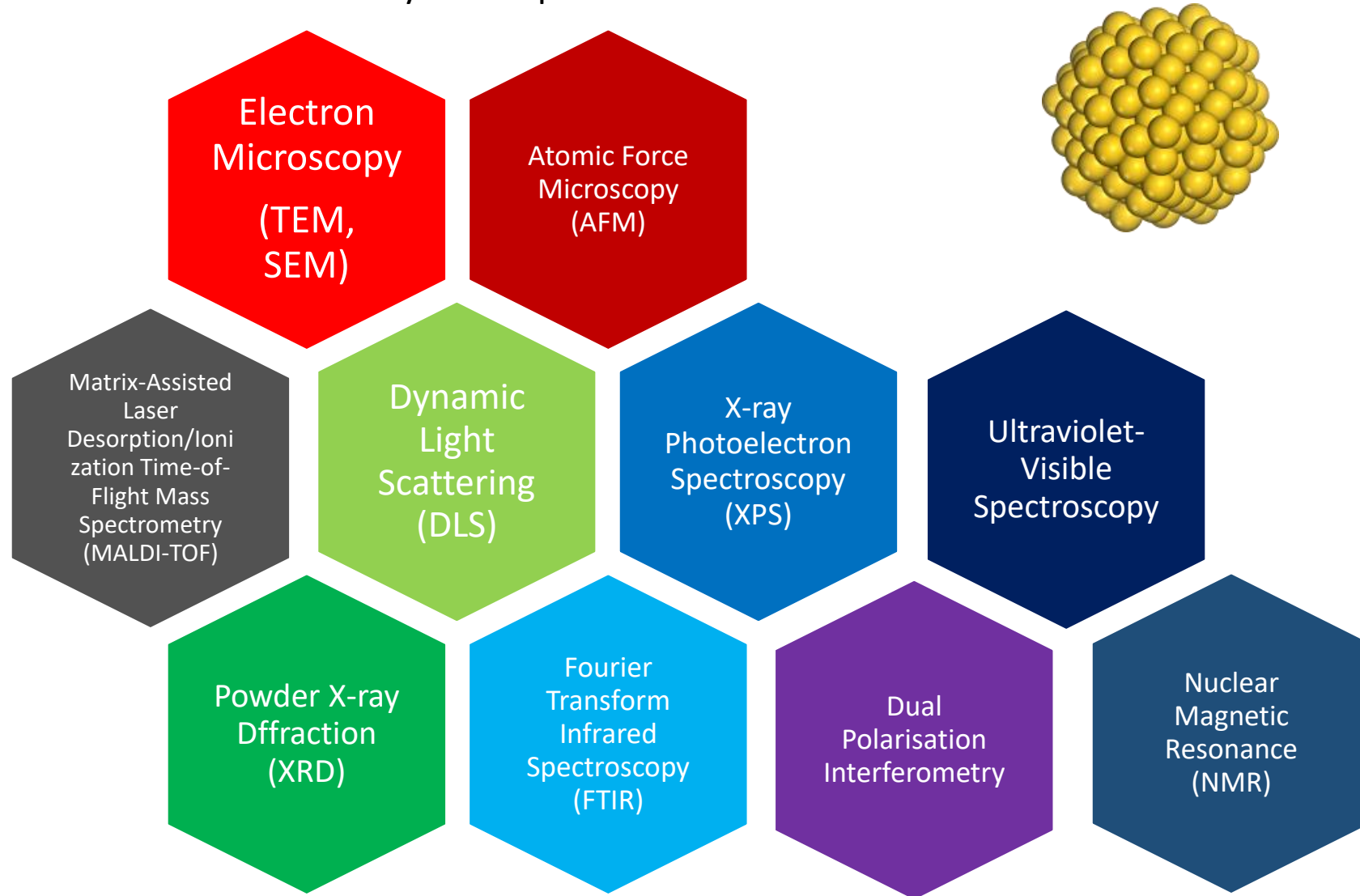


Anthropogenic nanoparticles



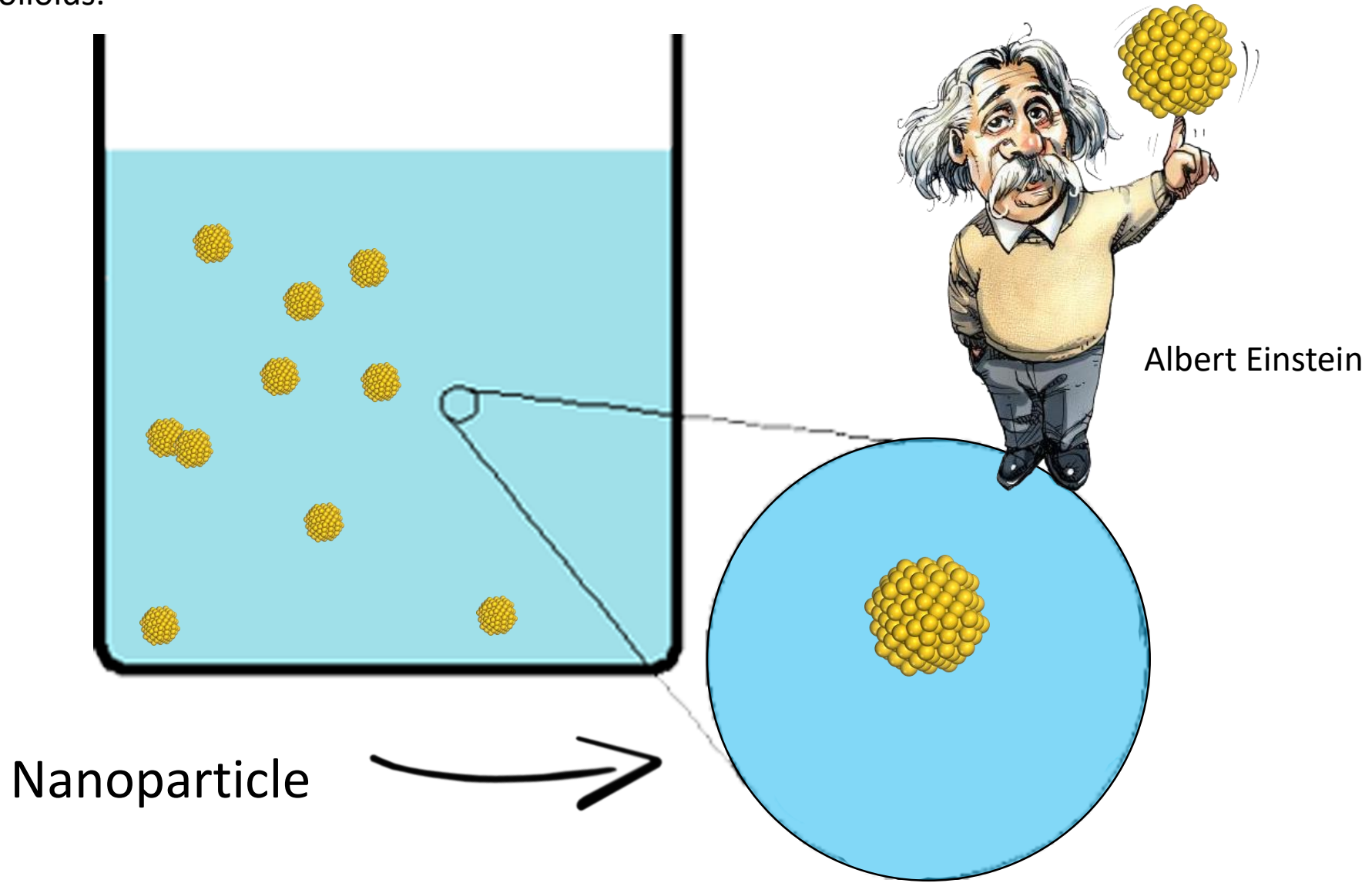
Techniques to study nanoparticles

Although nanoparticles are very small and seem to have a simple structure, to study nanoparticles scientists use many techniques:



Colloids

Do you know what are colloids? A **colloid** is a substance microscopically dispersed throughout another substance. Albert Einstein studied the behavior of nanoparticles in colloids.

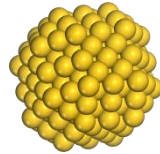


How many nanoparticles are contained in a gram of this?

1 g Nanoparticles

150.000 nanoparticles/person

7.000.000.000 person
(population of Earth)



100 nm

=



x



1 g Nanoparticles

=

1.050.000.000.000.000 nanoparticles

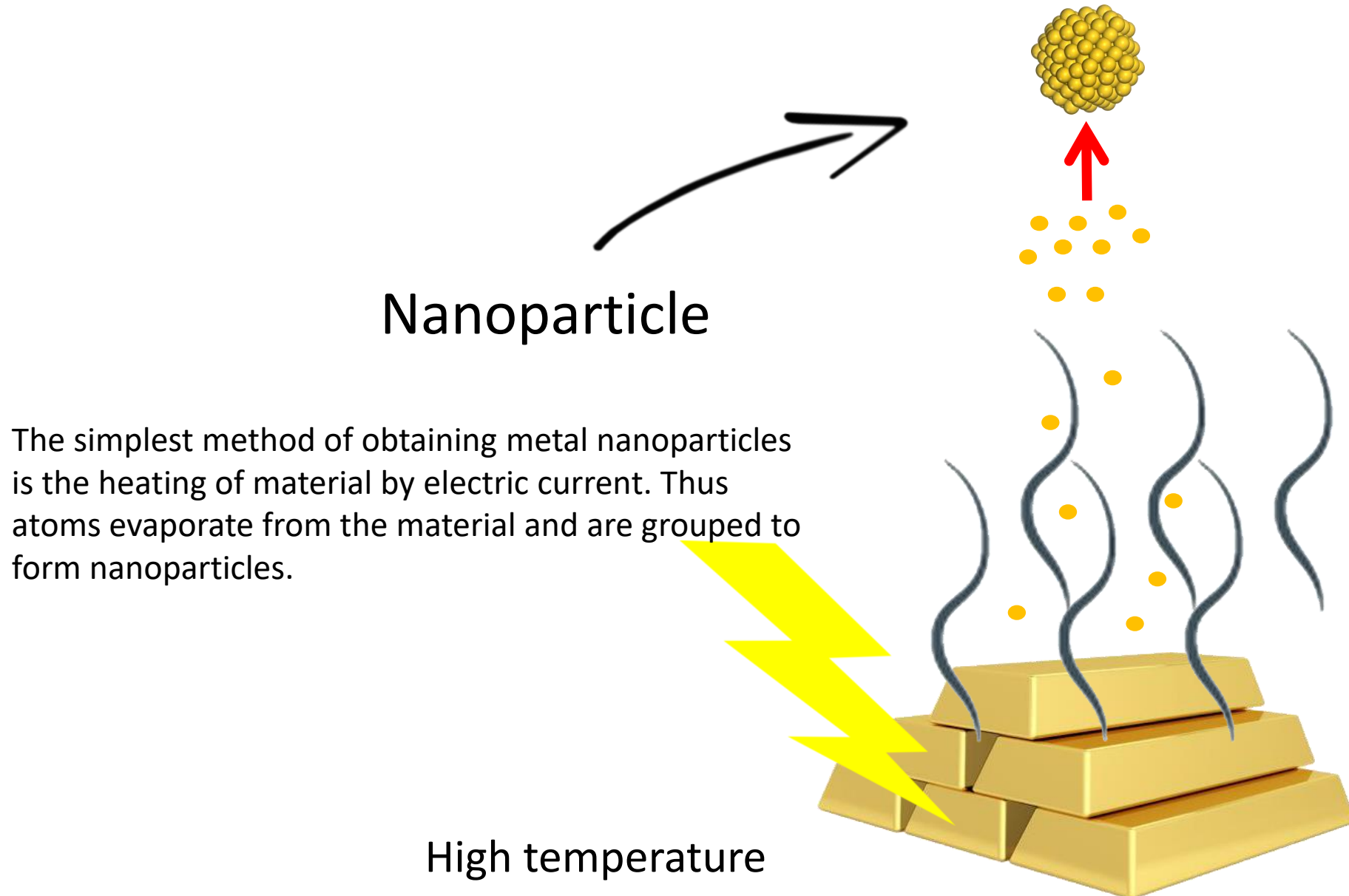
1,05 quadrillion nanoparticles



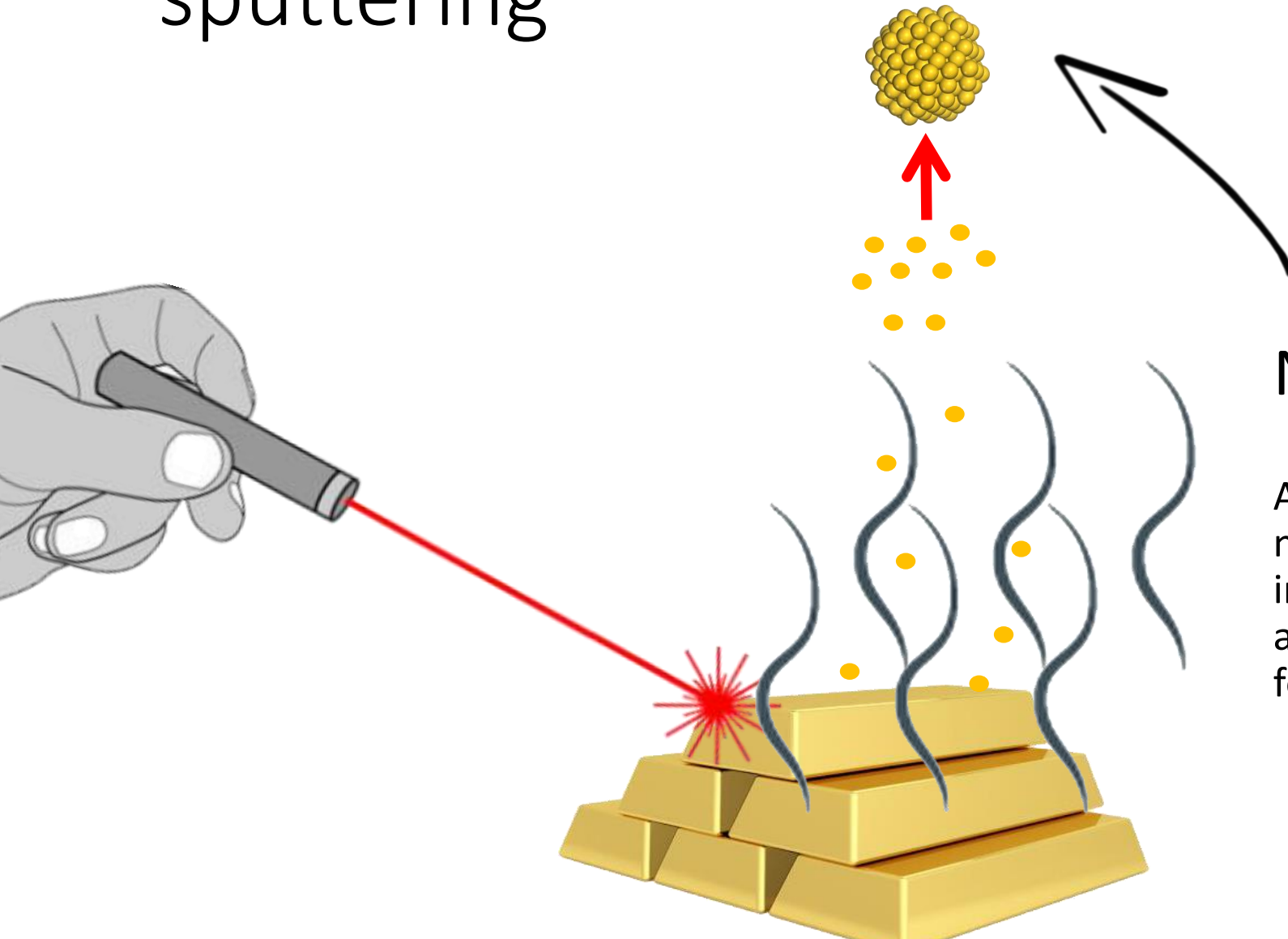
SYNTHESIS OF NANOPARTICLES

HOW SCIENTISTS OBTAIN NANOPARTICLES?

Thermal evaporation



Preparation of nanoparticles metal vapor sputtering



Nanoparticle

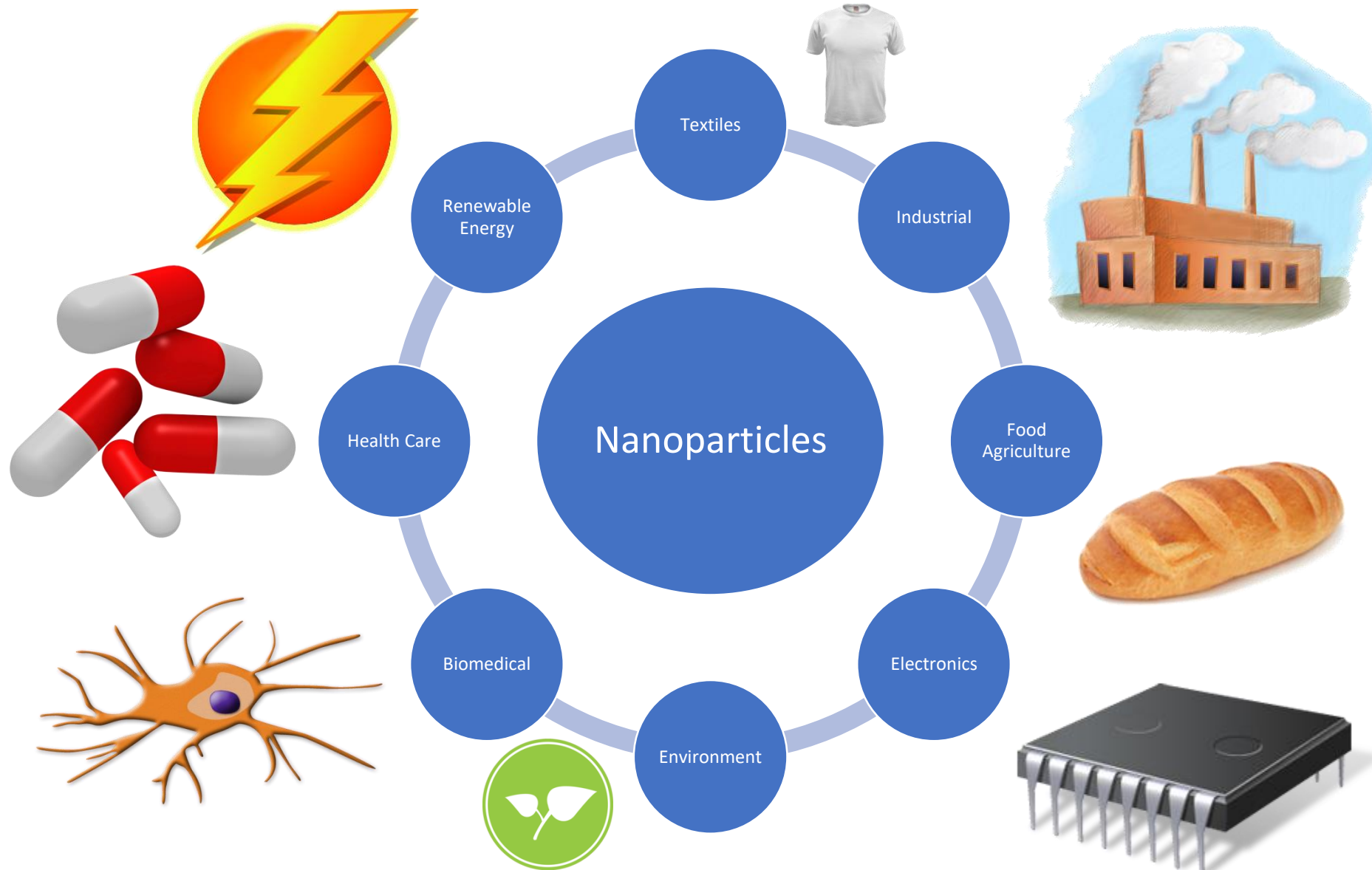
Another method for obtaining the nanoparticles is based on LASER interaction with material leading to atoms evaporation that can group and form nanoparticles

Mechanochemical dispersion

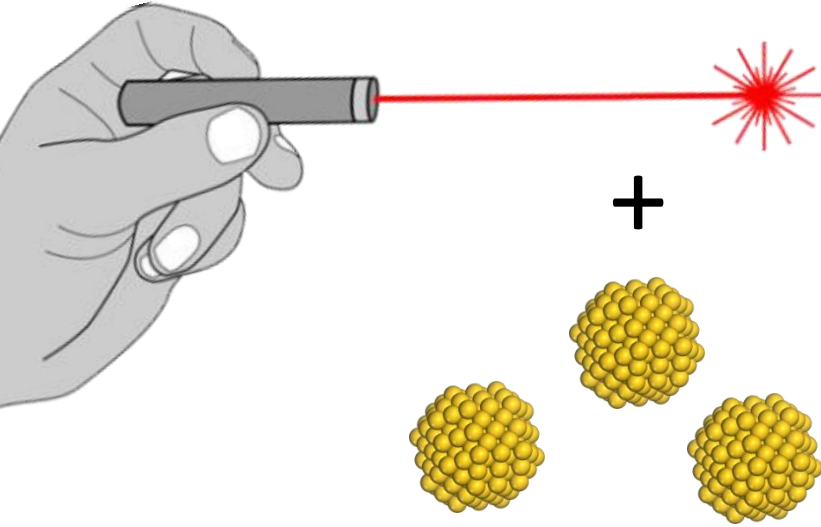


A very interesting method for obtaining nanoparticles is mechanochemical dispersion which is based on a special mill.

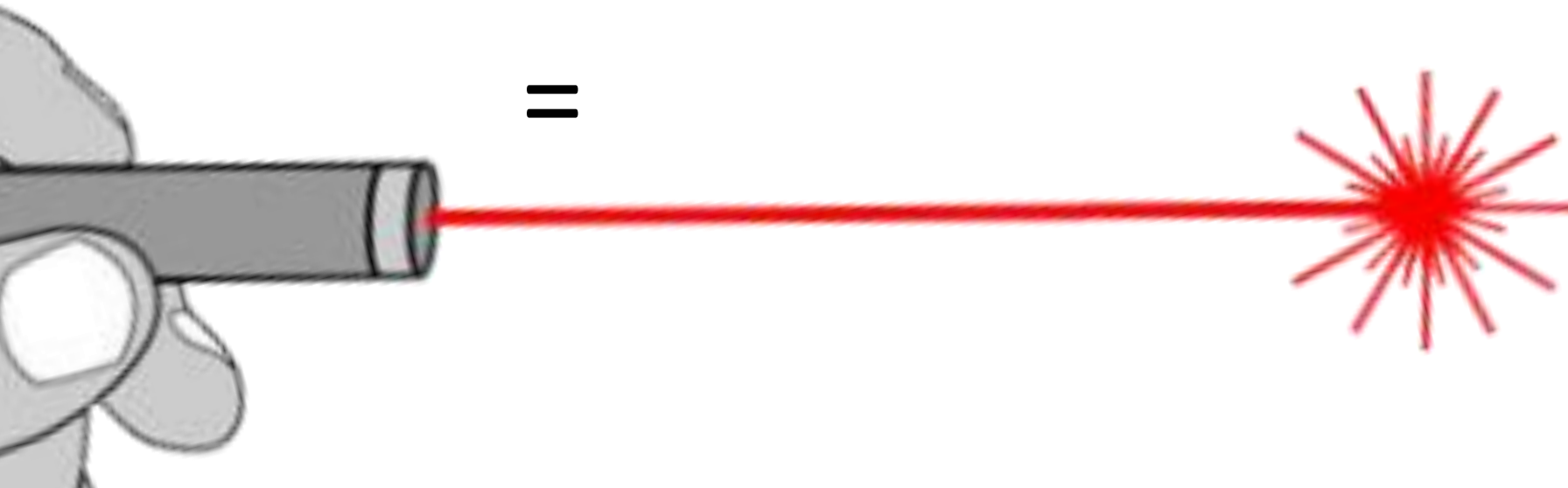
Applications of nanoparticles



LASER Applications

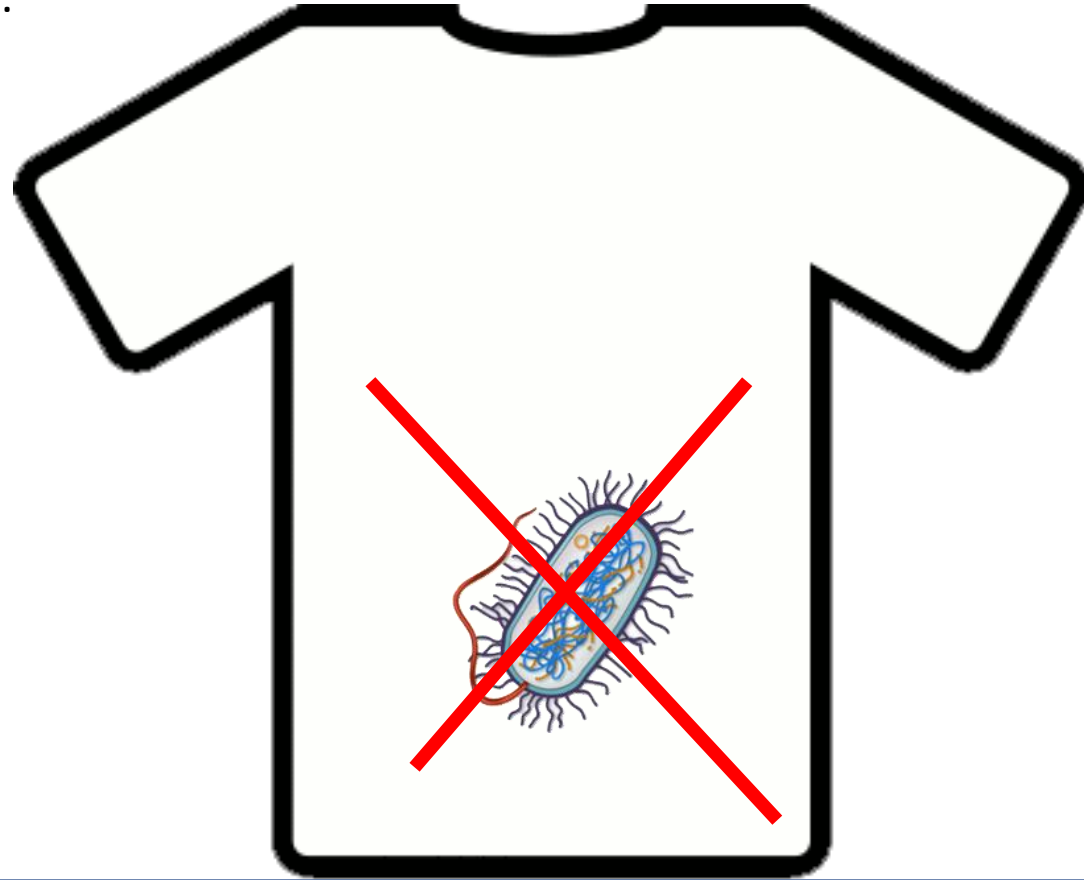
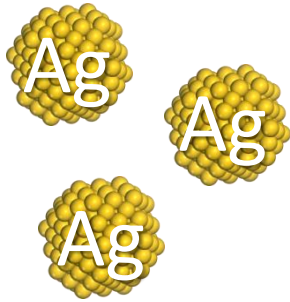


In technology, it was observed that nanoparticles can help improve some lasers.

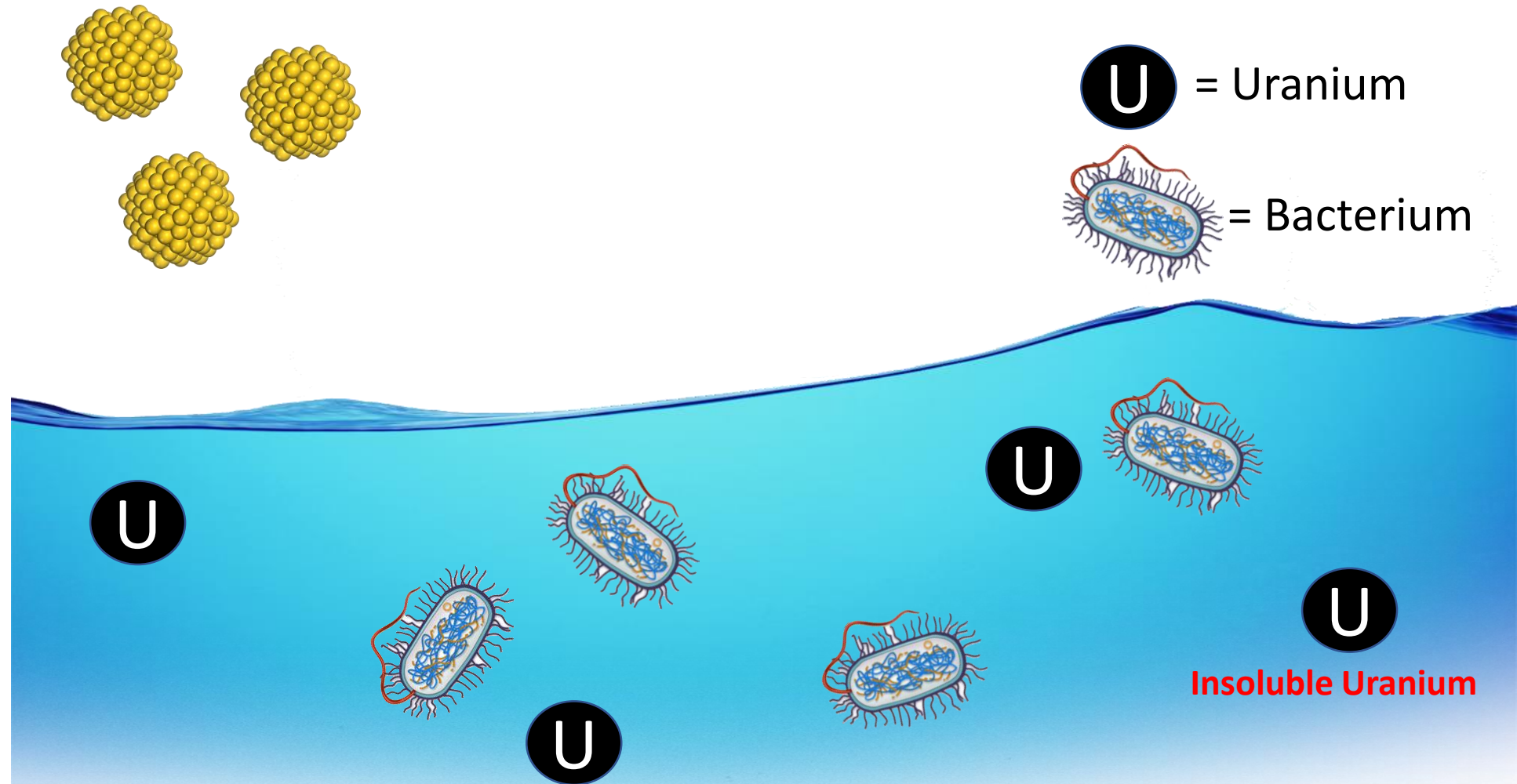


Elimination of bacteria with nanosilver

For example, silver nanoparticles can easily destroy bacteria on clothing, keeping clothes clean for a long time.

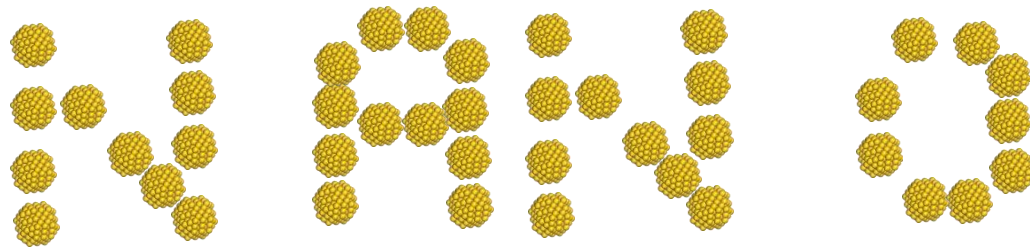


Bioremediation with nanoparticles



They can help in environmental bioremediation. With the help of special nanoparticles, it can clean water from radioactive metals, such as uranium.

Do cosmetics contain nanoparticles?



titanium dioxide
zinc oxide
iron oxides
magnesium stearate
various clays
sericite matt
pearl essence
boron nitride
bismuth oxychloride.

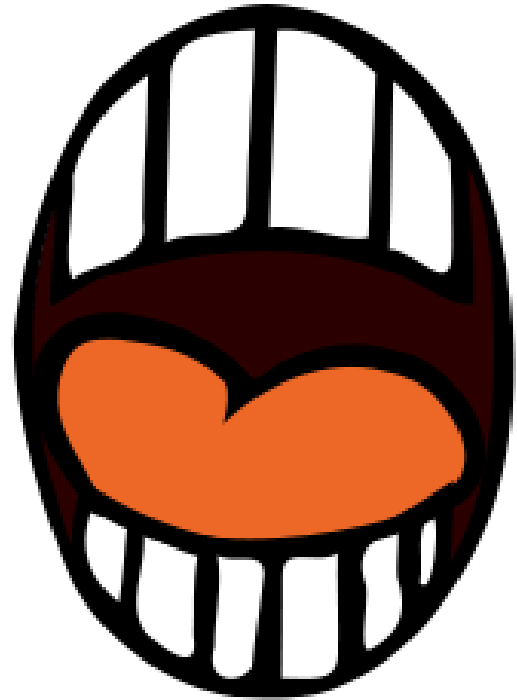
Do you know that nanoparticles have entered in cosmetics? Some of these ingredients, such as titanium dioxide, zinc oxide, various clays are nanoparticles.



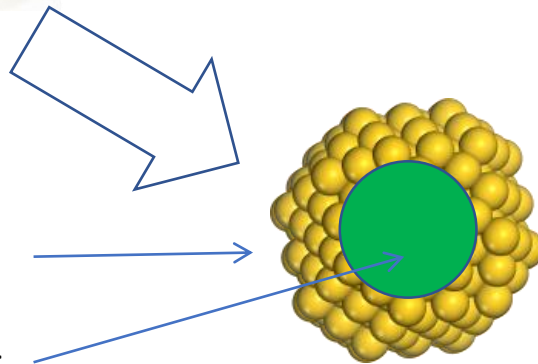
Nanoparticles vs. Cancer



~~Cancer~~

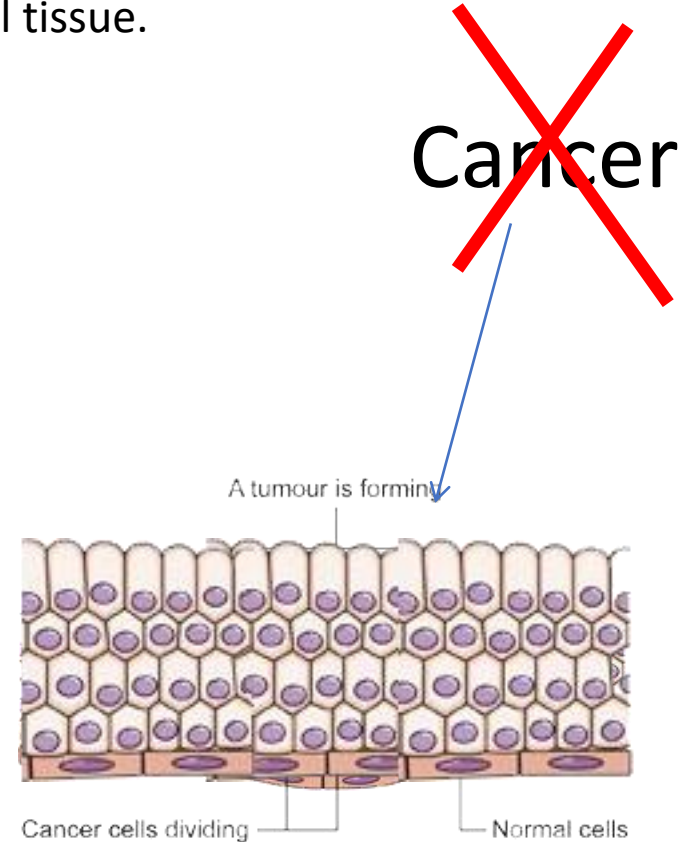
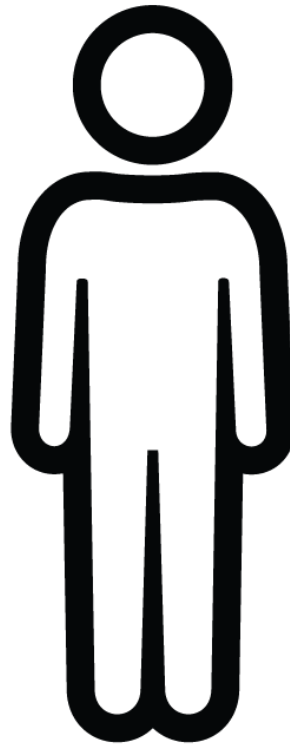
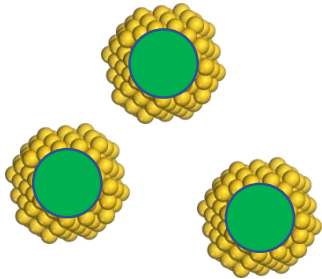


Nanoparticle
Green Tea Extract



Nanoparticles vs. Cancer

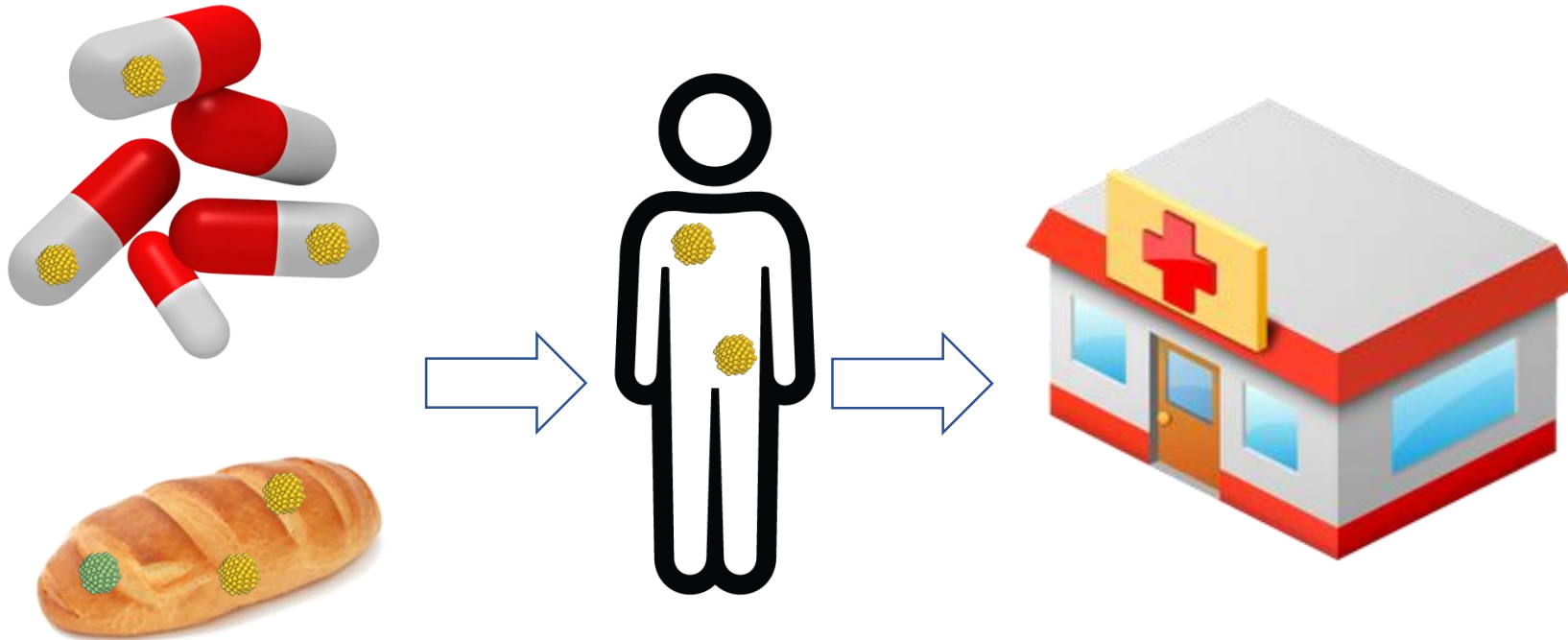
Researchers have created some pills that being consumed, leading to the destruction of cancer cells and recovery of normal tissue.



Nanoparticles and health

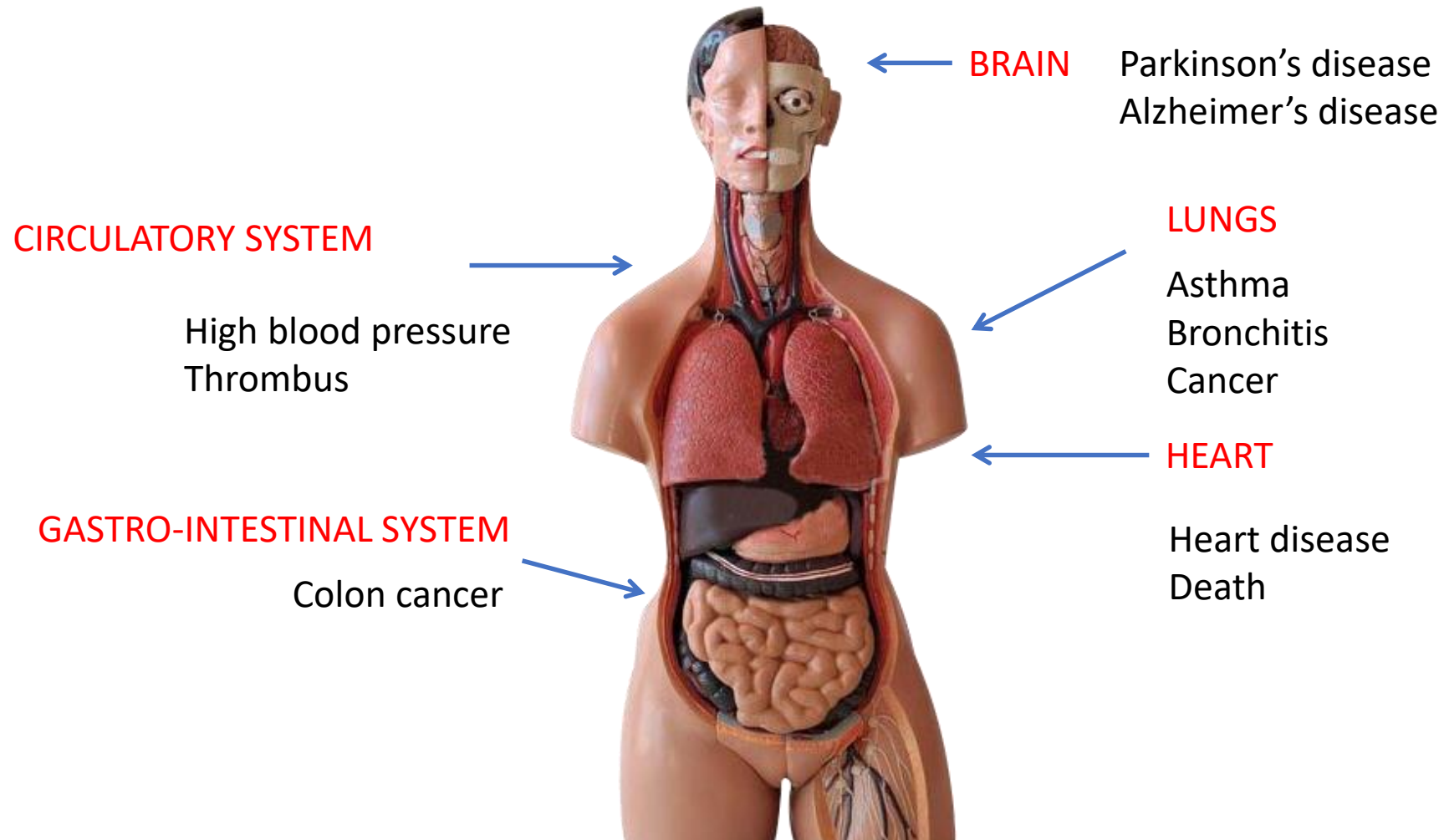
Bad Nanoparticles

Diseases



But not all nanoparticles are good for health. Some nanoparticles arriving with the foods and drugs in the body can lead to serious diseases.

Diseases associated with nanoparticles





TITLE

- Text



TITLE

Text



TITLE

- Text



TITLE

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