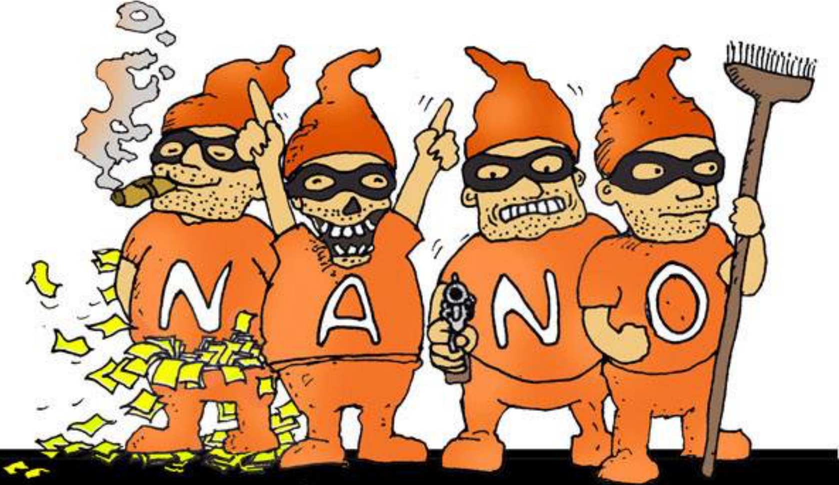


A comic illustrated by

géraldine grammon

Produced with support from:

AGIR pour l'environnement

Avicenn
Association de Veille et d'Information Civique
sur les Enjeux des Nanosciences et des Nanotechnologies

FRANCE NATURE ENVIRONNEMENT

générations FUTURES

EEB
European Environmental Bureau

CENTER FOR FOOD SAFETY

c2ds
comité
développement
durable
santé

Friends of the Earth Australia

etc GROUP
monitoring power
tracking technology
strengthening diversity

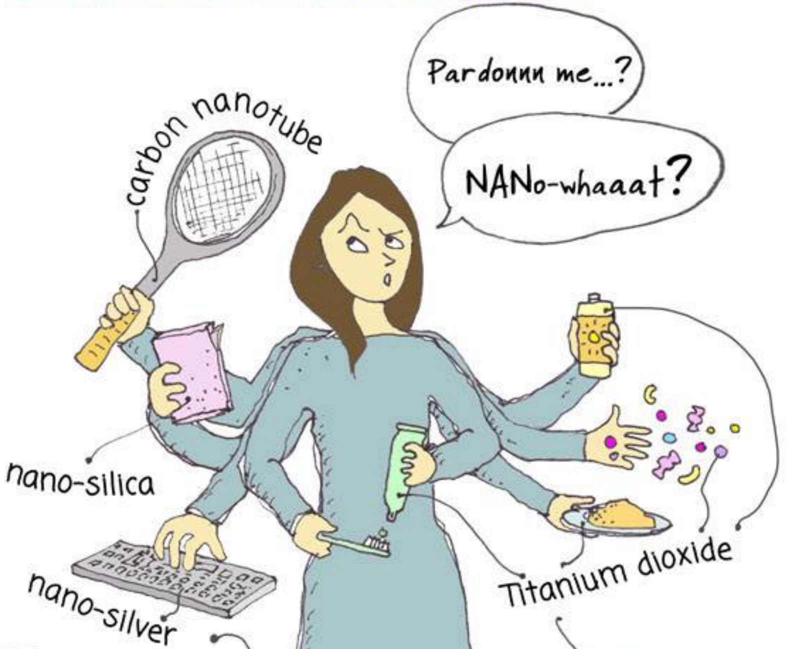
CIEL
CENTER for INTERNATIONAL ENVIRONMENTAL LAW

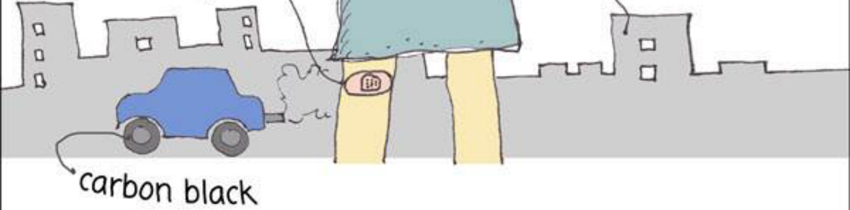
IATP Institute for Agriculture & Trade Policy

IPEN
a toxics-free future

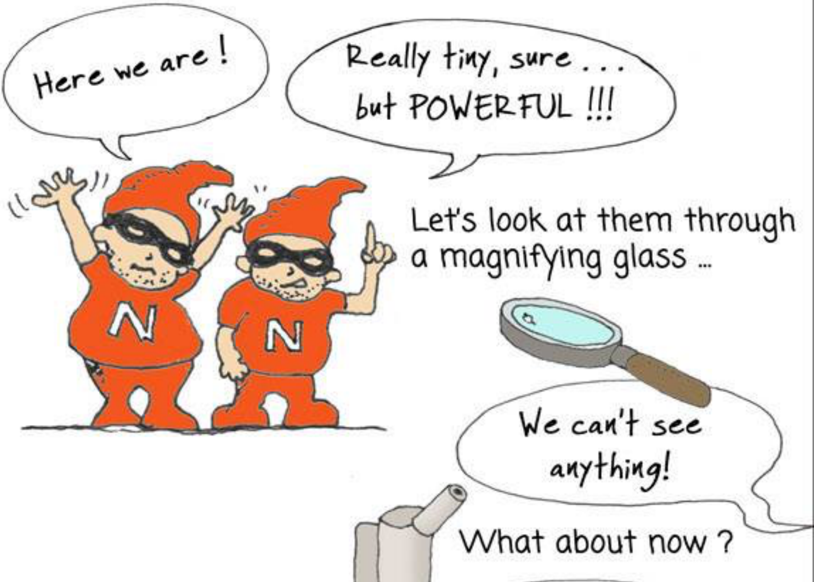
1 It's impossible to see them, yet we are constantly exposed to them:

NANOPARTICLES !


Pardonnn me...?
NANo-whaaat?
carbon nanotube
nano-silica
nano-silver
Titanium dioxide

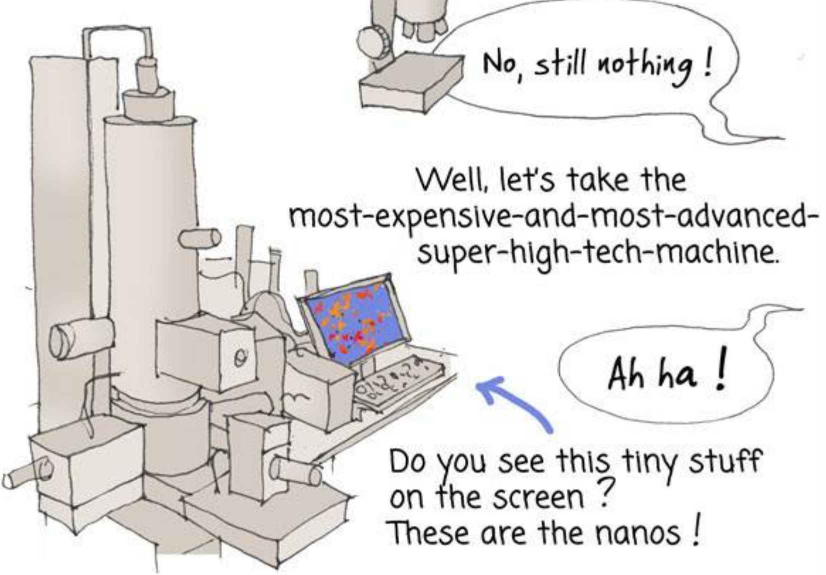

carbon black

Don't worry, we'll explain:
the greek word "nannos" means "dwarf".
Nanoparticles are extremely tiny, infinitely small.


Here we are!
Really tiny, sure... but POWERFUL !!!
N
N
We can't see anything!

Let's look at them through a magnifying glass ...

What about now ?


No, still nothing !
Well, let's take the most-expensive-and-most-advanced-super-high-tech-machine.
Ah ha !
Do you see this tiny stuff on the screen ? These are the nanos !

2

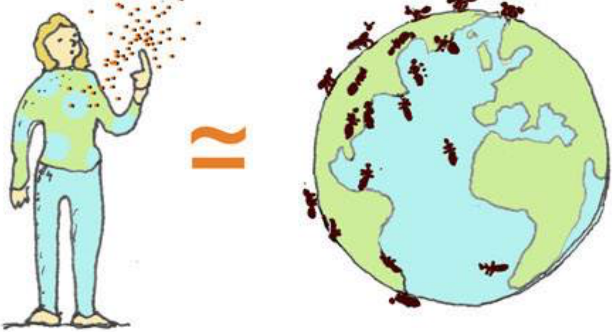
LISTEN UP : MATHEMATICS ! !

1 nanometer = 0 , 000 000 001 meter

To give you an idea :

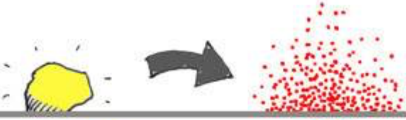
A nanometer
is to a human ...

... what an ant
is to earth!



The size of a cell nucleus is roughly between 1 and 100 nm.
And at this scale, materials have

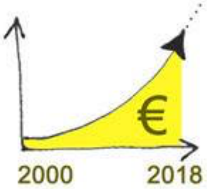
EXCEPTIONAL PROPERTIES !!!

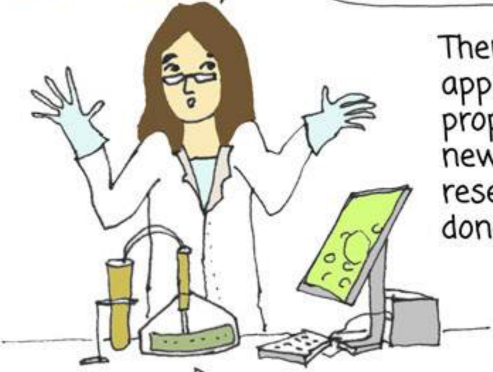


GOLD turns red !!!

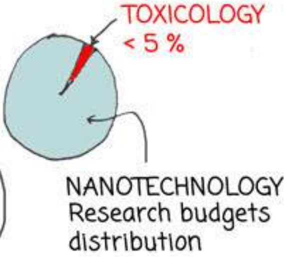
And **ALUMINUM**, which is usually inert, becomes **EXPLOSIVE** !!!

As a result, for 20 years the chemical industry has dramatically increased investment in the creation of new nanomaterials. Miniaturization and the race for patents have become the general trend !



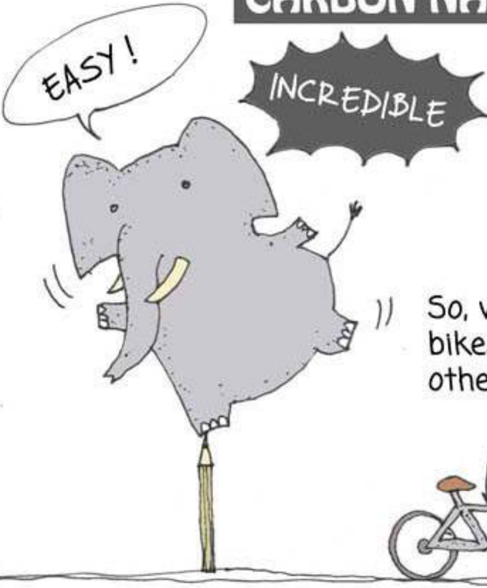

AMAZING !!!
We are discovering a new world; science fiction seems within reach !
Well obviously... There is no economic interest in toxicity studies !

There are promising applications ... but new properties also means new risks, and little research has been done to assess toxicity...

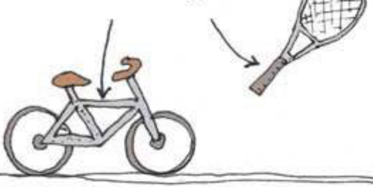


Let's look at some examples of nanomaterials :

CARBON NANOTUBES


EASY!
INCREDIBLE

They are 100 times as strong as steel !!! Imagine an elephant that could stand on a pencil lead ! So, we use them to make bikes, rackets and many other things.*

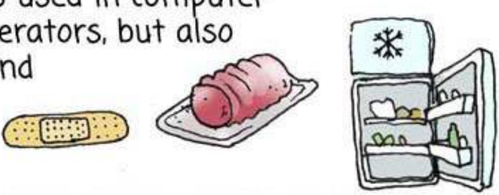


---

* SHsh . . . mum's the word but one small detail is often omitted : in reality, some carbon nanotubes closely resemble ASBESTOS fibers . . . not good for those who work in factories.

NANO-SILVER

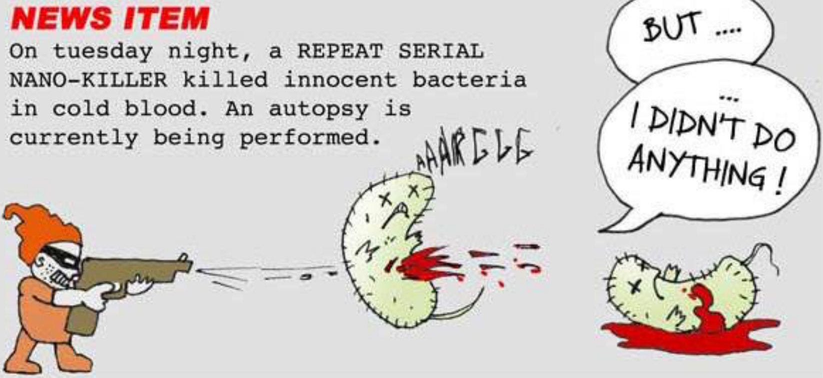
It kills bacteria. It is used in computer keyboards, in refrigerators, but also in food packaging and medical dressings.



But this little killer can't tell the difference between good and bad bacteria.

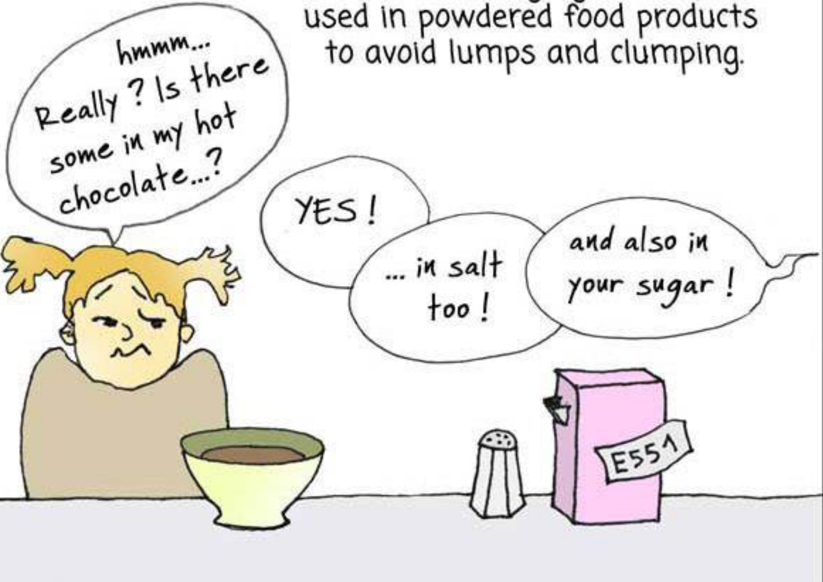
NEWS ITEM

On tuesday night, a REPEAT SERIAL NANO-KILLER killed innocent bacteria in cold blood. An autopsy is currently being performed.


AAARGLG
BUT ....
... I DIDN'T DO ANYTHING !

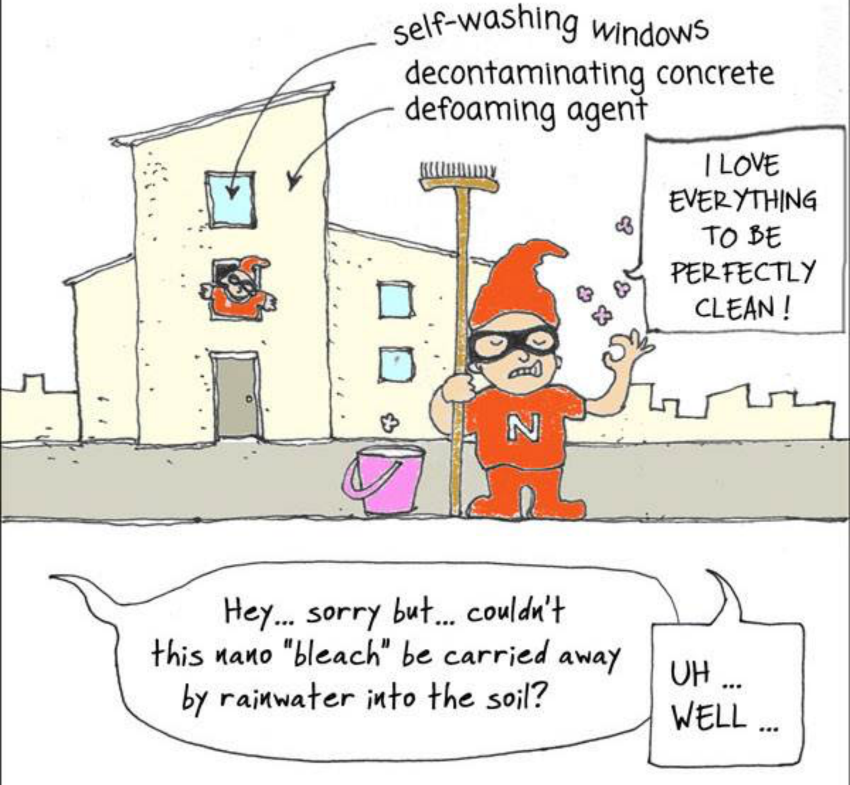
NANO-SILICA

It's an anti-caking agent, used in powdered food products to avoid lumps and clumping.

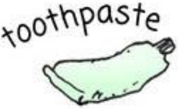

hmmm... Really ? Is there some in my hot chocolate...?
YES !
... in salt too !
and also in your sugar !
E551

TITANIUM DIOXIDE

This additive is a very powerful white pigment which becomes transparent at the nanoscale.
It creates a " CLEAN AND TIDY " effect.
You find it on building facades to facilitate their cleaning.


self-washing windows
decontaminating concrete
defoaming agent
I LOVE EVERYTHING TO BE PERFECTLY CLEAN!
N
Hey... sorry but... couldn't this nano "bleach" be carried away by rainwater into the soil?
UH ... WELL ...

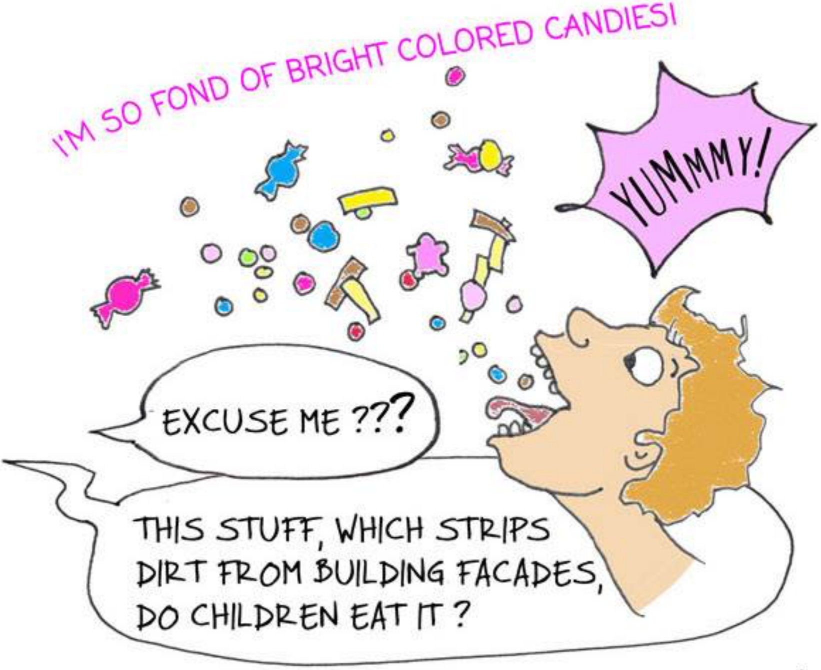
We will keep you posted (especially considering the enormous amounts of nano TiO_2 used in the construction industry)...
But we also find them in colored tattoos and in anti-UV cosmetics and toothpaste.


toothpaste

tattoo
NANO

And also
in our diet, it's called E 171

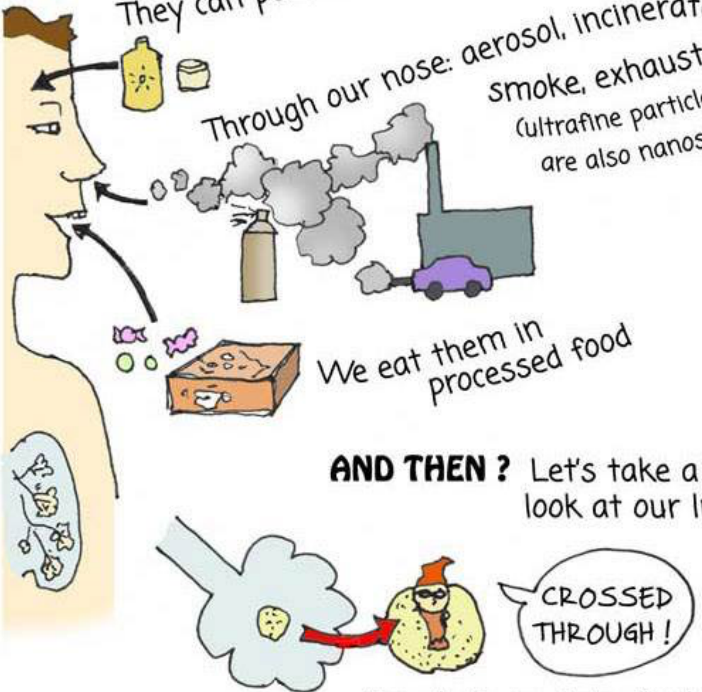
It's perfect for cake icings and sweets.


I'M SO FOND OF BRIGHT COLORED CANDIES!
YUMMMY!
EXCUSE ME ???
THIS STUFF, WHICH STRIPS DIRT FROM BUILDING FACADES, DO CHILDREN EAT IT ?

Well ... more or less ... THEY DO!

5

So, nanoparticles are everywhere and we are exposed to them all day long.



They can penetrate our body through our skin

Through our nose: aerosol, incinerator smoke, exhaust fumes (ultrafine particles are also nanos)

We eat them in processed food

AND THEN ? Let's take a look at our lungs :

CROSSED THROUGH !

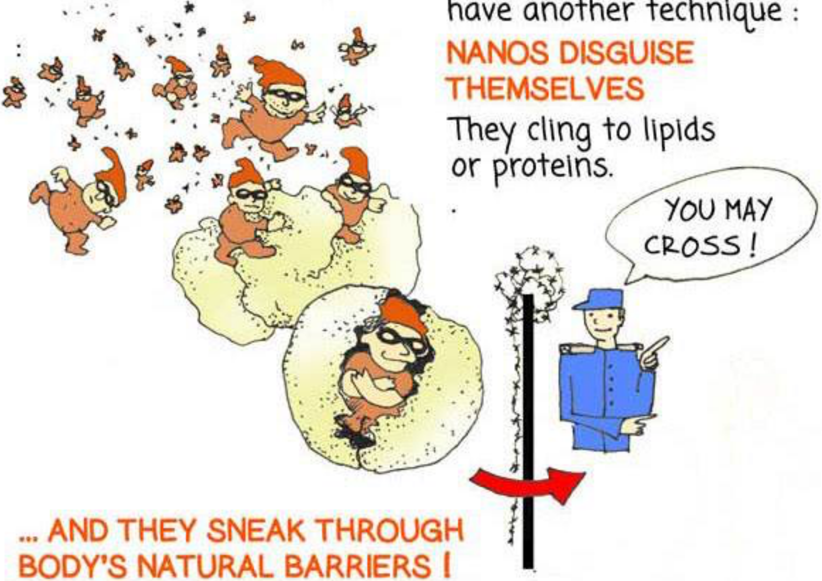
Now let's go... into the blood !

But how can they penetrate so deep ?
Doesn't our body have sophisticated natural barriers ?

... Sure ! But nanoparticles are so tiny, they manage to find their way everywhere ... and they also have another technique :

NANOS DISGUISE THEMSELVES

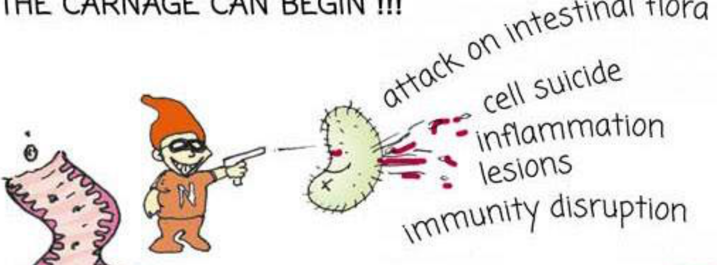
They cling to lipids or proteins.

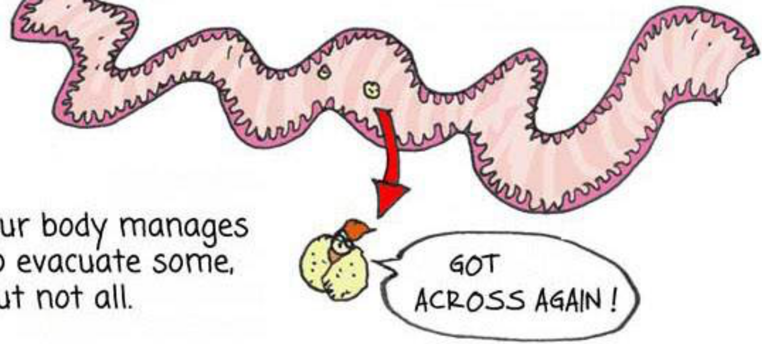

YOU MAY CROSS !

... AND THEY SNEAK THROUGH BODY'S NATURAL BARRIERS !

For example, nanoparticles in food may get into the intestine, and there ...

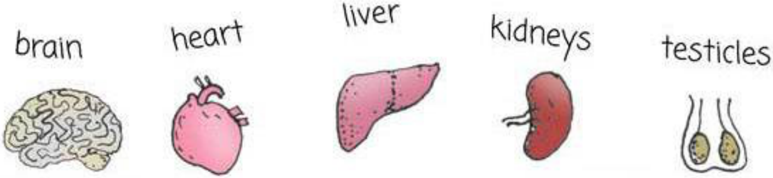
... THE CARNAGE CAN BEGIN !!!


attack on intestinal flora
cell suicide
inflammation
lesions
immunity disruption
N

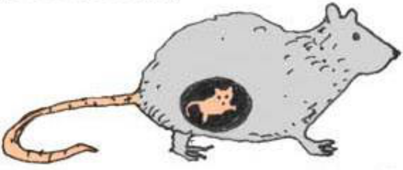

GOT ACROSS AGAIN !

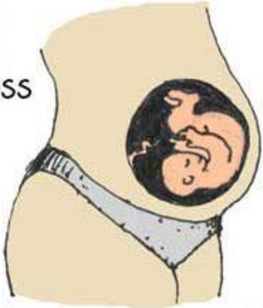
Our body manages
to evacuate some,
but not all.

6 AS A RESULT, we find nanoparticles stored in organs where they can cause adverse effects.


brain
heart
liver
kidneys
testicles

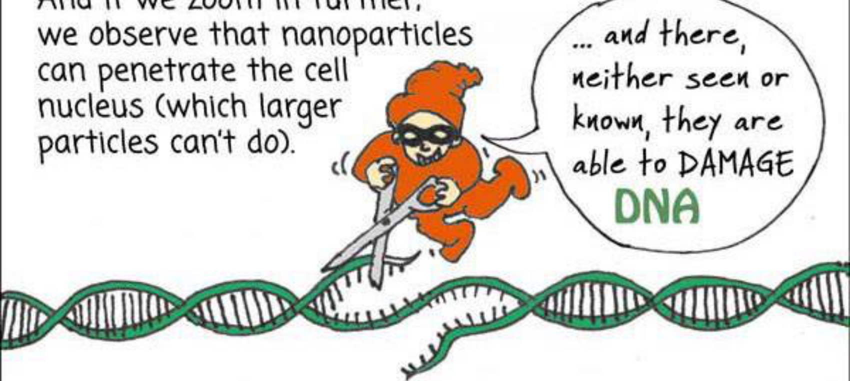
In pregnant female rats,
tests show that nanos can
successfully make their way across
the PLACENTA.



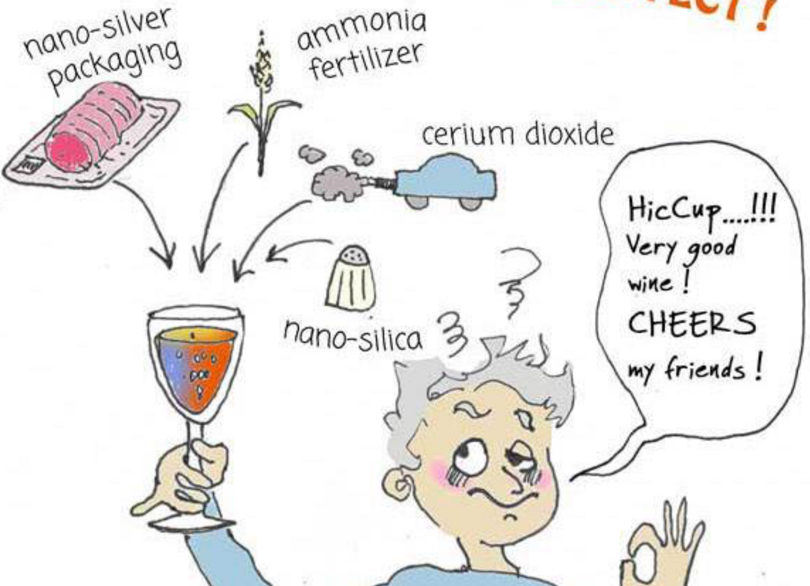


So, what about our babies ???

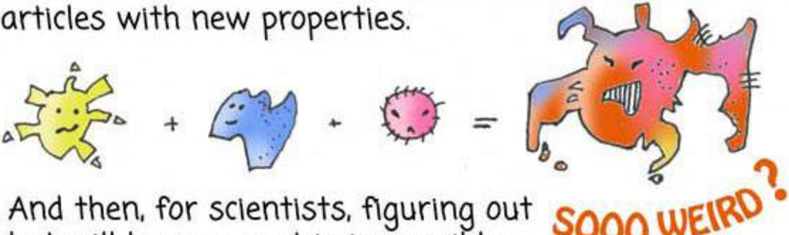
And if we zoom in further, we observe that nanoparticles can penetrate the cell nucleus (which larger particles can't do).


... and there, neither seen or known, they are able to DAMAGE DNA

It's still difficult for scientists to determine how nanomaterials act on a specific organ or type of cells. But, it's even more challenging when it comes to what is called : **THE COCKTAIL EFFECT !**


nano-silver packaging
ammonia fertilizer
cerium dioxide
nano-silica
HicCup....!!! Very good wine ! CHEERS my friends !

Indeed, particles that mix with each other and with other environmental contaminants can create new particles with new properties.



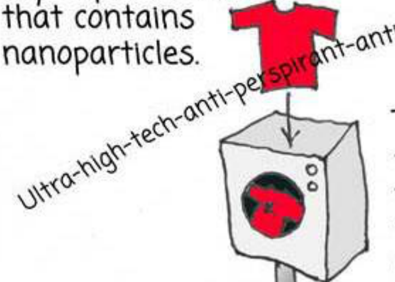
... And then, for scientists, figuring out what will happen next is impossible: it would require thousands of experiments !

7 Our body is not the only one to have problems getting rid of nanoparticles. It's the same with...

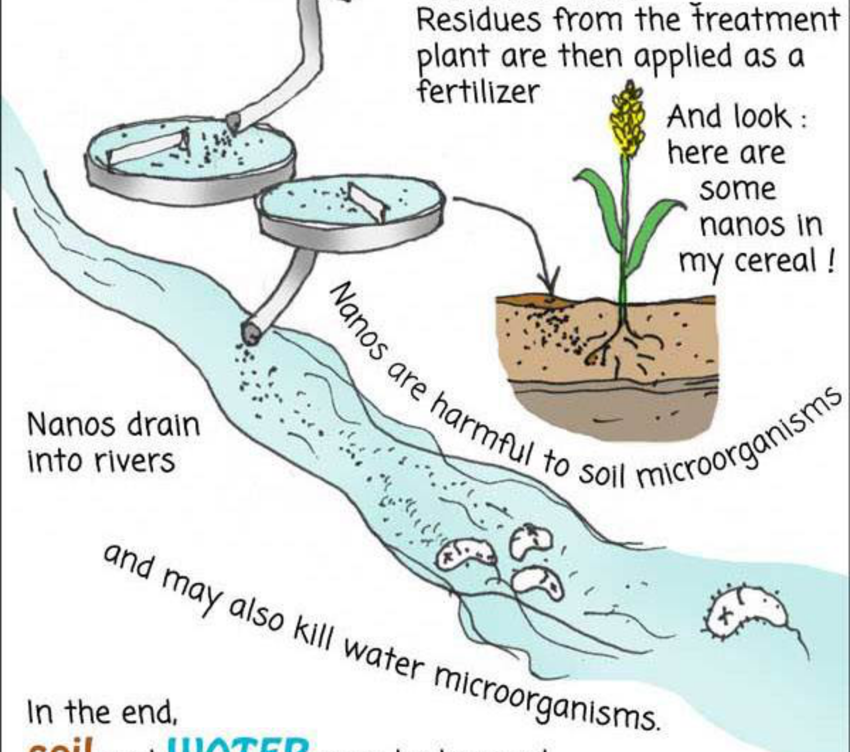
... our ENVIRONMENT

Nanos : when they GET there, they STAY there !!!

Let's see what happens for example, when I wash my super T-shirt that contains nanoparticles.


Ultra-high-tech-anti-perspirant-anti-bacterial-anti-all-revolutionary T-shirt

These nanoparticles will be found at the water treatment plant, which can't thoroughly eliminate them.



Residues from the treatment plant are then applied as a fertilizer

And look : here are some nanos in my cereal !

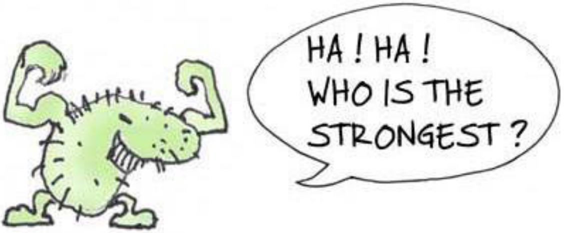
Nanos drain into rivers

Nanos are harmful to soil microorganisms

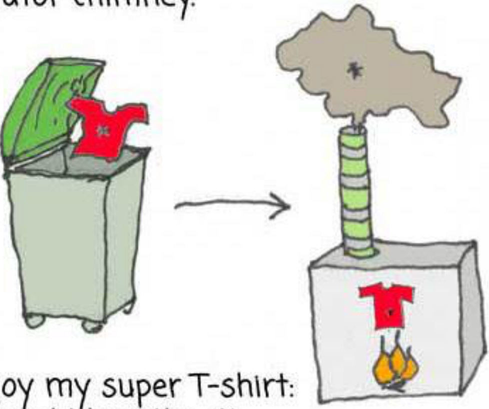
and may also kill water microorganisms.

In the end,
soil and **WATER** may be harmed.
This really wasn't needed !

As with antibiotics, we fear that nano-silver encourages the appearance of ULTRA-RESISTANT bacteria.


HA ! HA ! WHO IS THE STRONGEST ?

And the day I throw my T-shirt in the bin... Hummmm, I can inhale nanoparticles via the smoke from the incinerator chimney.



Finally, I fully enjoy my super T-shirt: I wear it, I eat it and I breathe it!

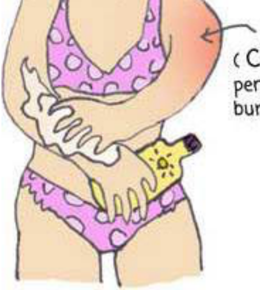
NOTHING is lost, NOTHING is created ...

... everything is transformed !

8

Here is a second example of contamination via water: this time we are on the beach. Sunscreen used to be white. But thanks to nanoparticles, it has now become fluid and transparent.

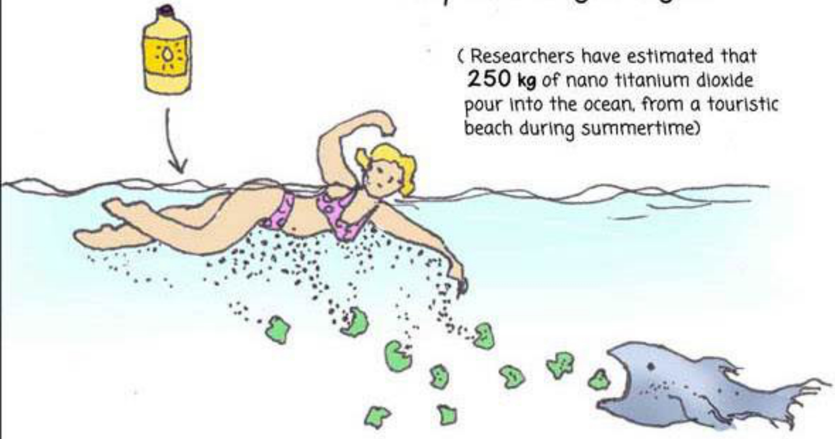
CAN YOU SPREAD IT ON MY BACK DARLING ??!



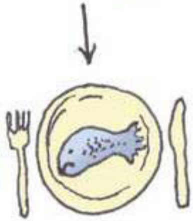
(Careful, Nanos are likely to penetrate skin damaged by sunburn. Better stay in the shade.)

And when we go swimming, nanos may enter the **phytoplankton** and kill part of these tiny and fragile algae.

(Researchers have estimated that **250 kg** of nano titanium dioxide pour into the ocean, from a touristic beach during summertime)

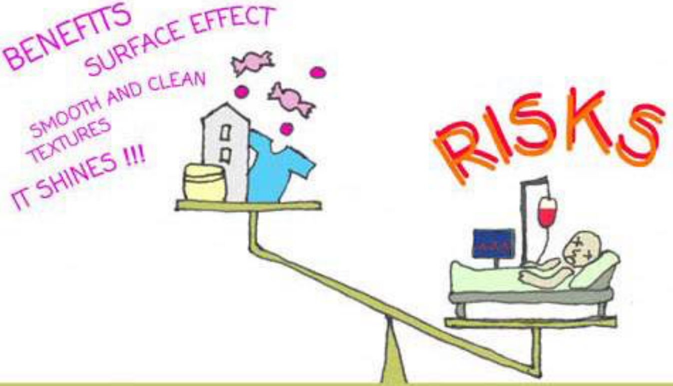


So, **FISH** have less phytoplankton to eat, and either die or arrive on our plate SEASONED WITH NANOS !



AT A CERTAIN POINT,
WOULDN'T IT BE A GOOD IDEA
TO REFLECT ON THE RISK/BENEFIT
BALANCE IN NANO ?!??

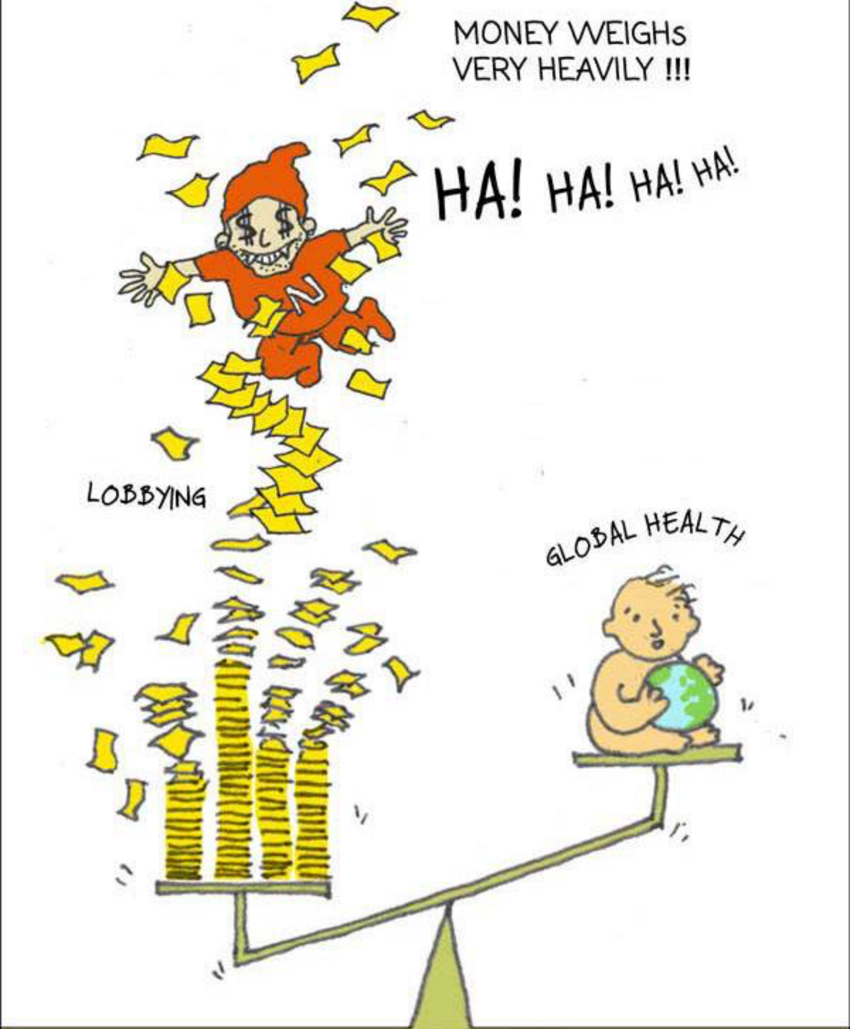
Some nano promises (in medicine or energy conservation for example) may seem attractive. But is it really necessary to use these ingredients in everyday products ?


BENEFITS
SURFACE EFFECT
SMOOTH AND CLEAN
TEXTURES
IT SHINES !!!
RISKS

Isn't there a proverb that reads :
"Prevention is better than cure" ?

THE PRECAUTIONARY PRINCIPLE

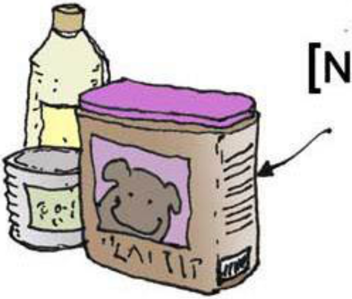
So we wonder how we got here. Well, governments are overwhelmed and are under pressure from industrial lobbies.


MONEY WEIGHS VERY HEAVILY !!!
HA! HA! HA! HA!
N
LOBBYING
GLOBAL HEALTH

POWER

REGULATION

By a law decreed in Europe, the word **[NANO]** must appear on food packaging in the ingredients list since 2014. But industrial firms have not complied with the law.



[NANO] ???

Yet associations which have randomly tested consumer products have systematically found nanos in them.

TRACEABILITY

Nano-registers have been developed in several European states, where produced or imported nanomaterials must be registered.

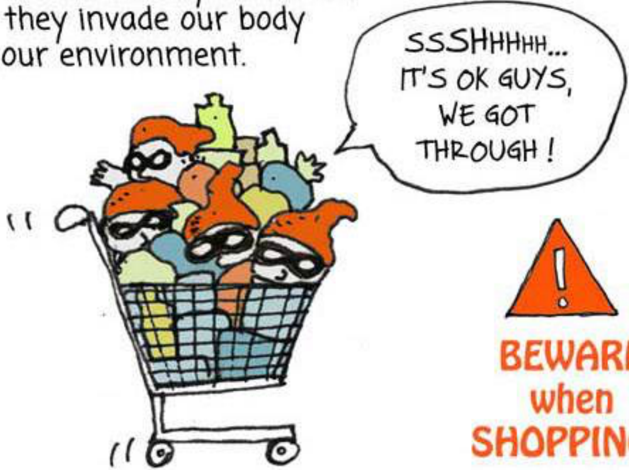
+ 400 000 tons / year in France !!!

It's huge, it amounts to 7 kg per person (and still more, since manufacturers are far from declaring all of them). So far, these registers are not effective enough : they don't enable us to identify the final products in which these materials are added.

and what about everyday life ?

WHAT CAN WE DO ???

NANOPARTICLES are everywhere, so the less we buy them, the less they invade our body and our environment.


SSSHHHHH...
IT'S OK GUYS, WE GOT THROUGH !

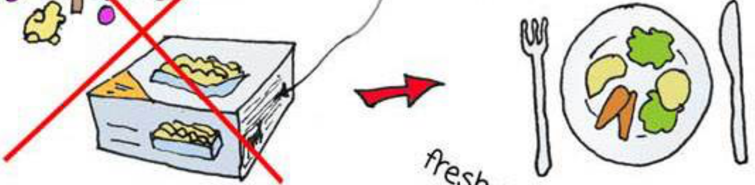
BEWARE when SHOPPING !

> Foodstuff

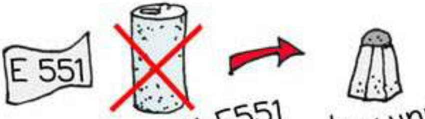
stop buying industrial candies and sweets

Keep away from E171 and from E551

Avoid processed food with long lists of ingredients full of additives and texturizing agents.



fresh market cooking



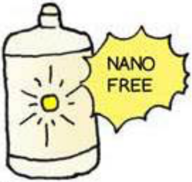
white salt E551

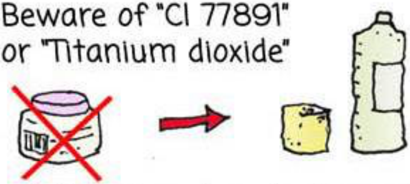
buy unrefined salt

(unrefined
sugar also)

> Cosmetics

Beware of "CI 77891"
or "Titanium dioxide"





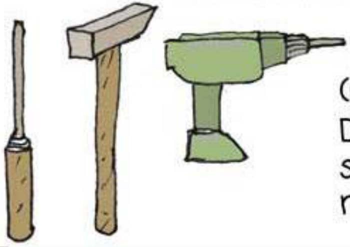
We can replace body creams
with shea butter cream or
organic vegetable oil.

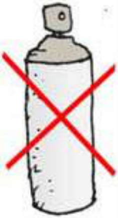
Buy Sunscreen without spray
Shade, hat, umbrella... common sense is nano-free !

> Textiles

Avoid 'industrial' materials
stain-resistant, odor-resistant,
wrinkle-free or waterproof fabrics ...
Best to use : natural materials.

> Handiwork





Avoid aerosol paints, containing nano-silver and titanium dioxide (CI pigment white 6)

Do not sand, scrape, pierce synthetic materials so as not to inhale dust.

OUR REQUESTS !

Civil society is coming together to :
- create a counter-power against lobbies
- propose concrete solutions
- inform citizens

1 Ban [nano] titanium dioxide

[nano] titanium dioxide likely to be ingested should be prohibited until the implementation of A MARKETING AUTHORIZATION PROCEDURE so that controls are carried out **BEFORE** products are placed on the market.

2 Inform

[NANO]

Labeling regulation must be complied with and extended to all consumer goods.

General public and exposed workers must be informed of the uses and **risks** of nanomaterials.

3 Ensure traceability

Nano registers should be created to ensure traceability of nanomaterials in **finished products**. Without monitoring and traceability, it is impossible to precisely evaluate the risks, and difficult to properly protect our health and environment.

Partner associations :

For futher information ...

... In French:

AVICENN: www.veillenanos.fr
Agir pour l'environnement: www.agirpourlenvironnement.org
France Nature Environnement: www.fne.asso.fr
C2DS: www.c2ds.eu
Générations futures: www.generations-futures.fr

... In English:

Center for international environmental law: www.ciel.org
ETC Group: www.etcgroup.org
Friends of the Earth Australia: www.emergingtech.foe.org.au
Institute for agriculture and trade policy: www.iatp.org
IPEN toxics-free: www.ipen.org
European Environmental Bureau: www.eeb.org
Center for food safety: www.centerforfoodsafety.org

NANO, illustrated documentary :
French edition : Oct. 2017 / English edition : June 2018