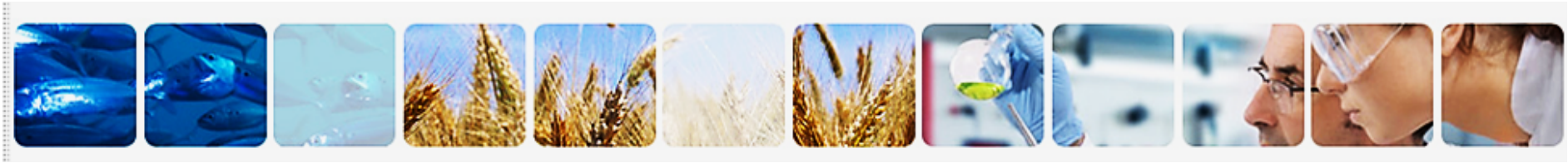

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Objectives:

To define nanotechnology.

To understand the basic scientific principles of nanotechnology.

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What is nanotechnology?

Nanotechnology is the ability to create and manipulate atoms and molecules on the smallest of scales.
'Nano' comes from the Greek word for dwarf.

How big is a 'nano'?

Nano means "billionth", so a nanometre is one *billionth* of a meter.

In other words, the nanoscale is 1000 times smaller than the microscopic scale and a billion (1000 million) times smaller than metres.

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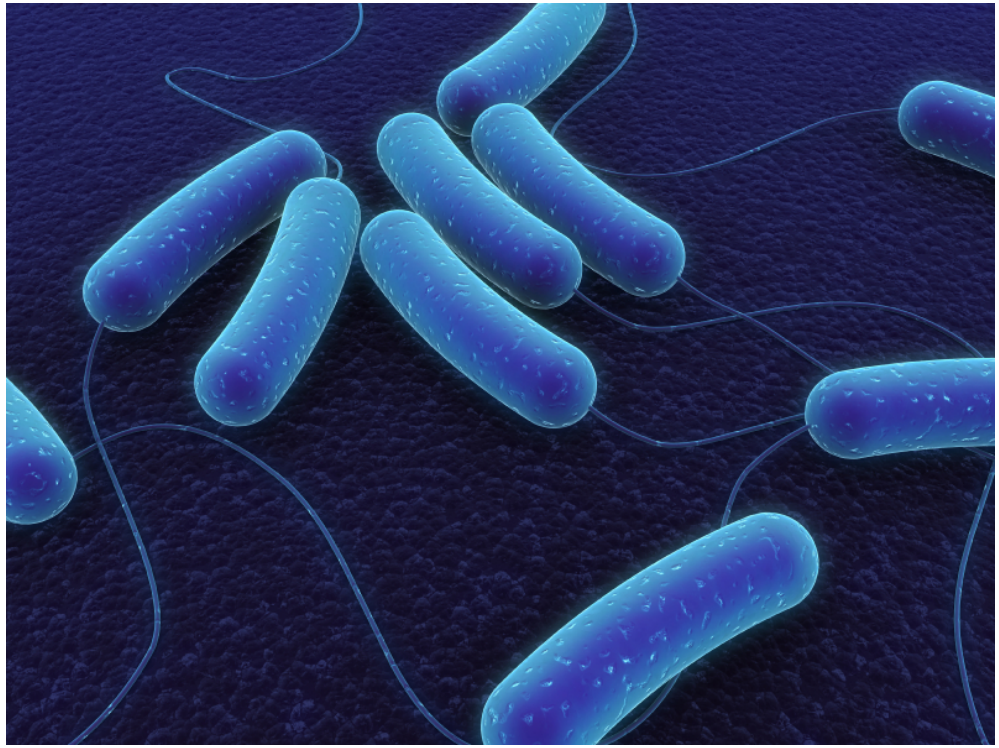
Electron microscopes allow us to see things on the nanoscale and to manipulate them.



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Nanotechnology offers a wide range of opportunities for the development of innovative products and applications for food packaging.

Nanotechnology and nanomaterials are a natural part of food processing and conventional foods, because the characteristic properties of many foods rely on nanometer sized components (such as nanoemulsions and foams).

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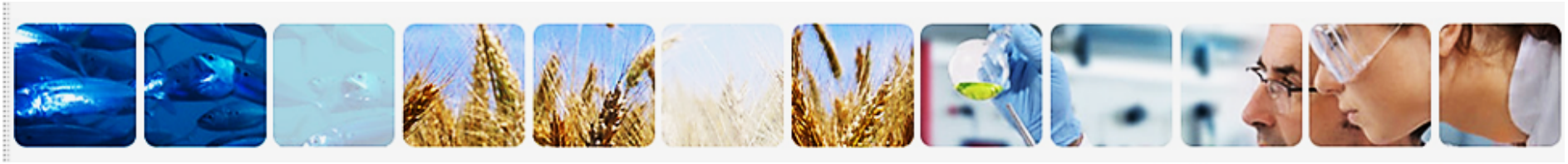
‘Nano’ foods now

All foods contain nano-particles.
Examples of foods that contain nanoparticles include milk and meat.

Milk contains caseins, a form of milk protein present at the nanoscale.
Meat is made up of protein filaments that are much less than 100nm thin.

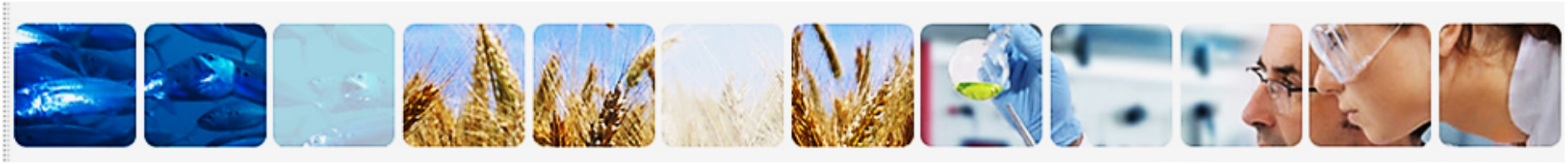
The organisation and change to the structures of these affects the texture and properties of the milk or meat.



Uses for nanotechnology in food

Nanotechnologies are being developed all the time.
Here are some examples that are being used:

- nanocarrier systems for delivery of nutrients and supplements;
- organic nano-sized additives for food, supplements and animal feed;



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- food packaging applications e.g. plastic polymers containing or coated with nanomaterials for improved mechanical or functional properties;
- nanocoatings on food contact surfaces for barrier or antimicrobial properties;
- nano-sized agrochemicals (a chemical used in agriculture, such as a pesticide or a fertilizer.);
- nanosensors for food labelling.

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Food examples

Nanoparticles are being used to deliver vitamins or other nutrients in food and drinks without affecting the taste or appearance.

These nanoparticles encapsulate the nutrients and carry them through the stomach into the bloodstream.

Nanoparticle emulsions are being used in ice cream and various spreads to improve the texture and uniformity.

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New developments in nano science and technology will allow more control and have the potential of increased benefits. These include:

- healthier foods (e.g. lower fat, lower salt) with desirable sensory properties;
- ingredients with improved properties;
- potential for the removal of certain additives without loss of stability;
- smart-aids for processing foods to remove allergens such as peanut protein.

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Packaging examples

Researches have produced smart packages that can tell consumers about the freshness of milk or meat.
When oxygen enters the package, nano-particles indicate the colour change and the consumer can see if the product is fresh or not.

Incorporation of nano particles in packaging can increase the barrier to oxygen and slow down degradation of food
during storage.

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Bottles made with nanocomposites minimise the leakage of carbon dioxide out of the bottle. This increases the shelf life of fizzy drinks without having to use heavier glass bottles or more expensive cans.

Food storage bins have silver nanoparticles embedded in the plastic. The silver nanoparticles kill bacteria from any food previously stored in the bins, minimising the spread of harmful bacteria.

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Nano in nature

Gecko feet are covered with nano-size hairs that use intermolecular forces, allowing the lizards to stick firmly to surfaces.

By replicating this scientists have developed an adhesive that can seal wounds or patch a hole caused by a stomach ulcer. The adhesive is elastic, waterproof and made of material that breaks down as the injury heals.

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Applications of nanotechnology

Agriculture	Processing	Products	Nutrition
New pesticides	Microencapsulation of flavours/aromas	UV protection	Neutraceuticals
Genetic engineering	Gelation agents	Antimicrobials	Nutrient delivery
Identity preservation	Nano emulsions	Condition and abuse monitors	Mineral/vitamin fortification
Sensors to measure soil conditions	Anti-caking	High barrier plastics	Drinking water purification
	Sanitation of equipment	Security/anti counterfeiting	Sensory characteristics of supplements
		Contaminant sensors	

The future of nanotechnology

Research is being carried out to develop nanocapsules containing nutrients that would be released when nanosensors detect a deficiency in your body.

Nanomaterials are being developed to improve the taste, colour and texture of foods. For example “interactive” foods are being developed that would allow you to choose which flavour and colour a food has.

Issues and concerns

Certain concerns have been raised in regard to the safety of the consumer resulting from a growing body of scientific evidence, which indicates that some free nanoparticles may cause harm to biological systems.

This is because they can penetrate cellular barriers, and induce oxyradical generation that may cause oxidative damage to the cell.

However, the nature and extent of risk to consumer health from ingestion of nanoparticles via food and drink are largely unknown.

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European Food Safety Authority

Since 2006 EFSA has been following developments in nanotechnology within its remit.
This includes reviewing the current state of knowledge and latest developments in nanotechnology with regard to food and feed:

- reviewing and adapting EU laws;
- monitoring safety issues;
- engaging in dialogue with national authorities; stakeholders and citizens.

www.efsa.europa.eu

efsa
European Food Safety Authority

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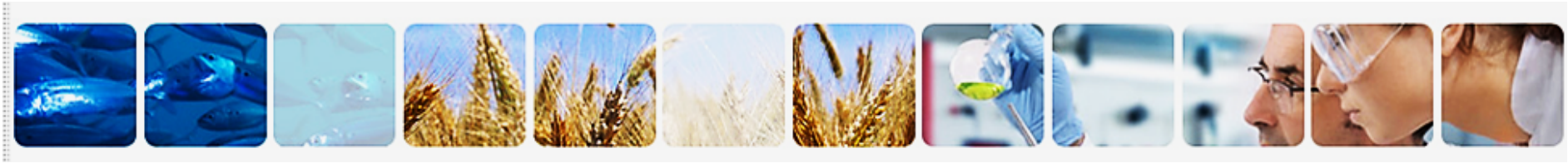

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