Also featuring the crystal...!

Nanocrystals in spider's web

For around 400 million years spiders have perfected highly sophisticated processes for capturing their prey. The spider's web is one of the wonders of technology and includes up to seven types of thread. Its strength is linked to its composition: a **succession of tiny rigid crystals and elastic polymer strands.**

Liquid crystals

A liquid crystal is **a phase between a liquid and a solid state**: it flows like a liquid but has the properties of a solid. The molecules of a liquid crystal are highly elongated and have the tendency to line up like matches or cigars in a box. They owe their name to their optical properties which are similar to those of crystals.

Crystals playing a role in the environmental process

Since the industrial revolution of the 19th century, the accumulation of metals in our environment (and the soil in particular) has accelerated. **The toxicity of these metals is linked to the mobility of metallic atoms and their availability to living organisms**, rather than their level of concentration. These factors depend on how the metals combine with components in the soil and the plants, behaviour that is often linked to the crystalline properties.

Bone replacement crystals

LEarly researchers were often perplexed by the chemical composition of bones and tooth enamel. These chemical compounds are very reactive nano-crystals known as apatites. We are now able, through **artificial biomineralization, to create crystalline replacements which imitate nature.**

***Araneus diadematus* in its web.**

Of all the silk threads produced by animals, the thread of the spider's web displays the most amazing physical characteristics, for its immense strength and elasticity. These apparently contradictory properties are explained by the structure of the thread, a polymer containing both nanocrystals and amorphous areas.

Metal precipitation protecting the roots of *Festuca rubra*

Certain plants can protect themselves from toxic metals in the soil by transforming these metals into insoluble products.

Crystallographic studies are important for determining the nature of the crystals containing these metals, assessing the risks and identifying the crystalline species (mineral, organic or alive) which could be used to reduce the bioavailability of toxic metals.

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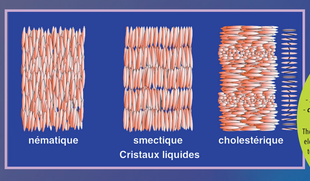

Georges Friedel studied **liquid crystals** producing beautiful images ... he classified them into three types:

- ***nematic***: the molecules are aligned but can be located anywhere,
- ***smectic***: the molecules are aligned and form layers
- ***cholesteric***: the orientation of the molecules changes to form a helix ..

The orientation of the molecules can be controlled by an electric field. This property makes liquid crystals essential to the production of flat screens capable of producing both correct images and colour

Liquid crystals are also to be found in nature, in the shell of the Cetonid flower beetle for example.

Hip replacements and rebuilding bones

Given the difficulties involved in reconstructing bone tissue, modern orthopaedic surgery has turned to bone grafting. But here the difficulties of harvesting the patient's own bone tissue and the risk of transmitting viruses through foreign transplants (human or animal) have led to work on synthetic bone substitutes. Recent studies have shown the importance of biomaterials favouring bone growth and mineralization.

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