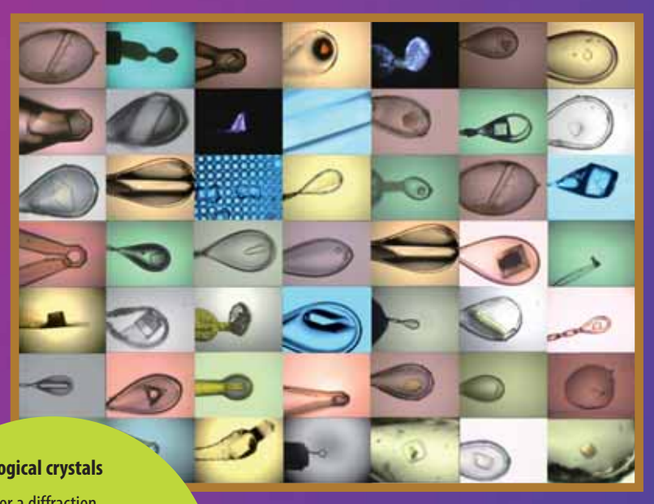
Using crystals to understand living organisms



Biological crystals

Prepared for a diffraction experiment. © EMBL-Grenoble

The crystals of proteins and other biological macromolecules are among the most difficult to obtain and they are never very large. Those of these photos are smaller than a millimeter!

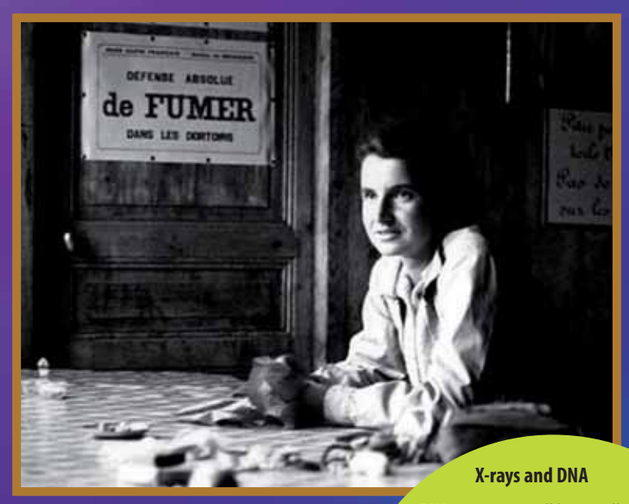
At the interface between chemistry and biology: in order to understand the way a living organism functions as well the role of the various proteins involved, scientists have long sought to see their structures. For this, X-ray diffraction has proved to be an extremely powerful technique. It does have one limitation: the proteins must be in a crystalline form.

"Growing" protein crystals ...

Proteins are very large biological molecules (macromolecules) and essential for life. They are made of amino acids. Each protein has a specific function, directly linked to its three-dimensional structure, i.e. the manner in which the amino acids are laid out, one against the other in space.
Proteins do not naturally form crystals, so these **crystals have to be grown** artificially.

... to study them.

There exists a very strong relationship between the atomic arrangement (the structure) of a biological macromolecule and its function: the precise knowledge acquired about its forms means that a hypothesis can be made regarding its role and the manner in which it carries out its function. Studies relate to both basic research, in order to acquire a **precise understanding of the biological processes**, and applied research, leading to the **synthesis of new medicines**.



X-rays and DNA

DNA is present in all living cells. It is the basis of heredity. It consists of two complementary strands formed by two regular sequences of small molecules, a coiled double helix. It can replicate into more molecules identical to each other, the property that is the basis of genetics. This is the image of X-ray diffraction from crystallites in a fiber of DNA, obtained in 1951 by **Rosalind Franklin**, who help to determine the shape of the molecule.

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Macromolecules

Biological macromolecules are large molecules composed of thousands to hundreds of thousands of atoms.
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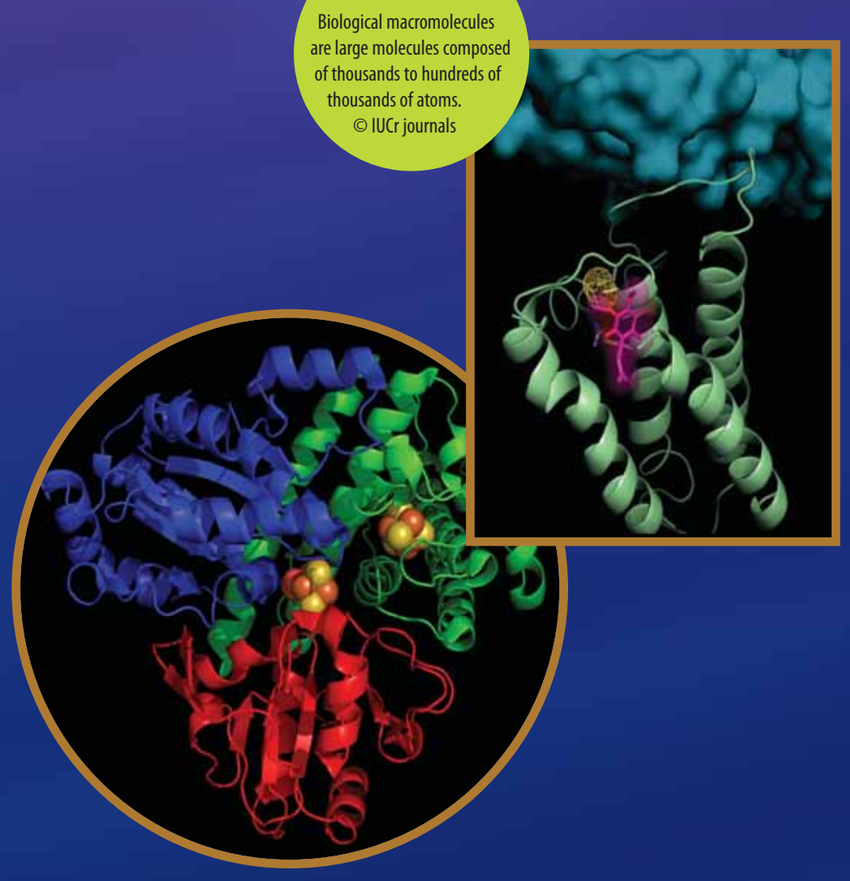

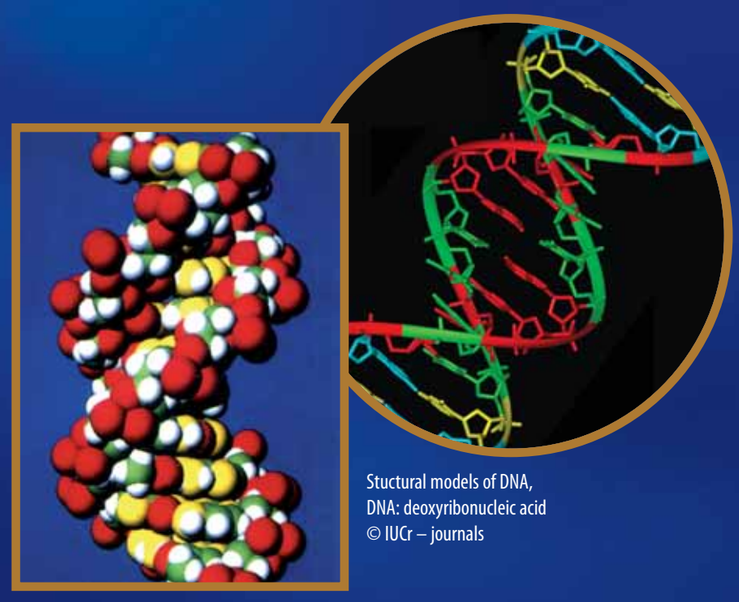

Stuctural models of DNA,
DNA: deoxyribonucleic acid
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