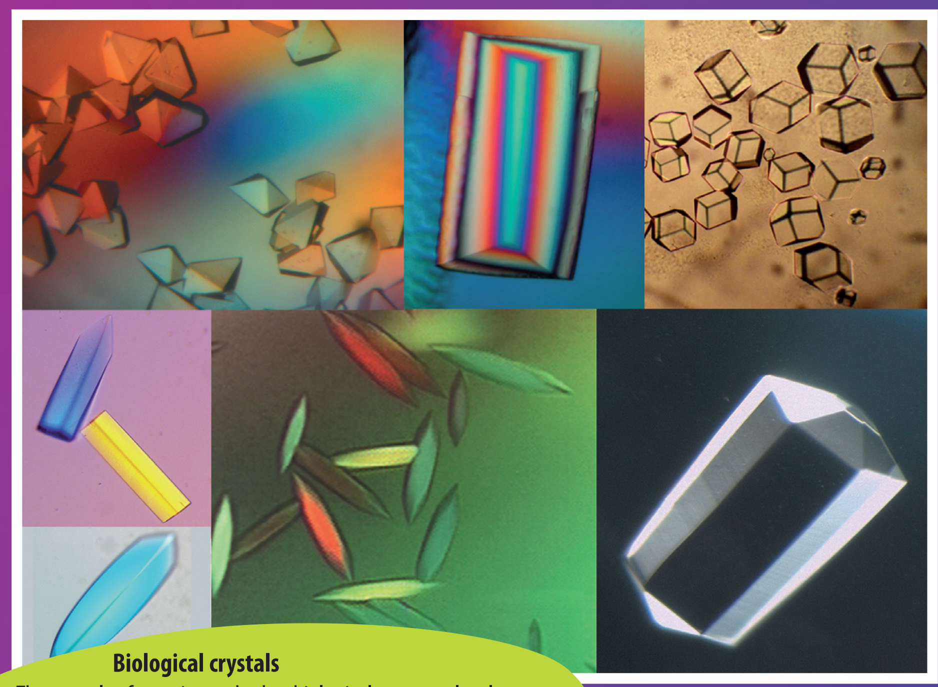
Growing crystals



Biological crystals
The crystals of proteins and other biological macromolecules are among the most difficult to obtain and they are never very large. Those in these photos are smaller than a millimeter!
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The specific qualities of crystals make them key materials for a large number of technological fields such as electronics, communications, energy, medicine and defence. For all these areas, it is of paramount importance to have crystals with the appropriate properties, size and quality. Crystal growth has become a major technological challenge.

Divalent copper sulfate hydrate
Growth by slow evaporation at constant temperature, with seeds, grown on quartz. Duration: about three weeks. Copper sulphate is known for its antiseptic and bactericidal properties. It has long been used by winemakers from the Bordeaux soup in the fight against pests.
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Crystallisation

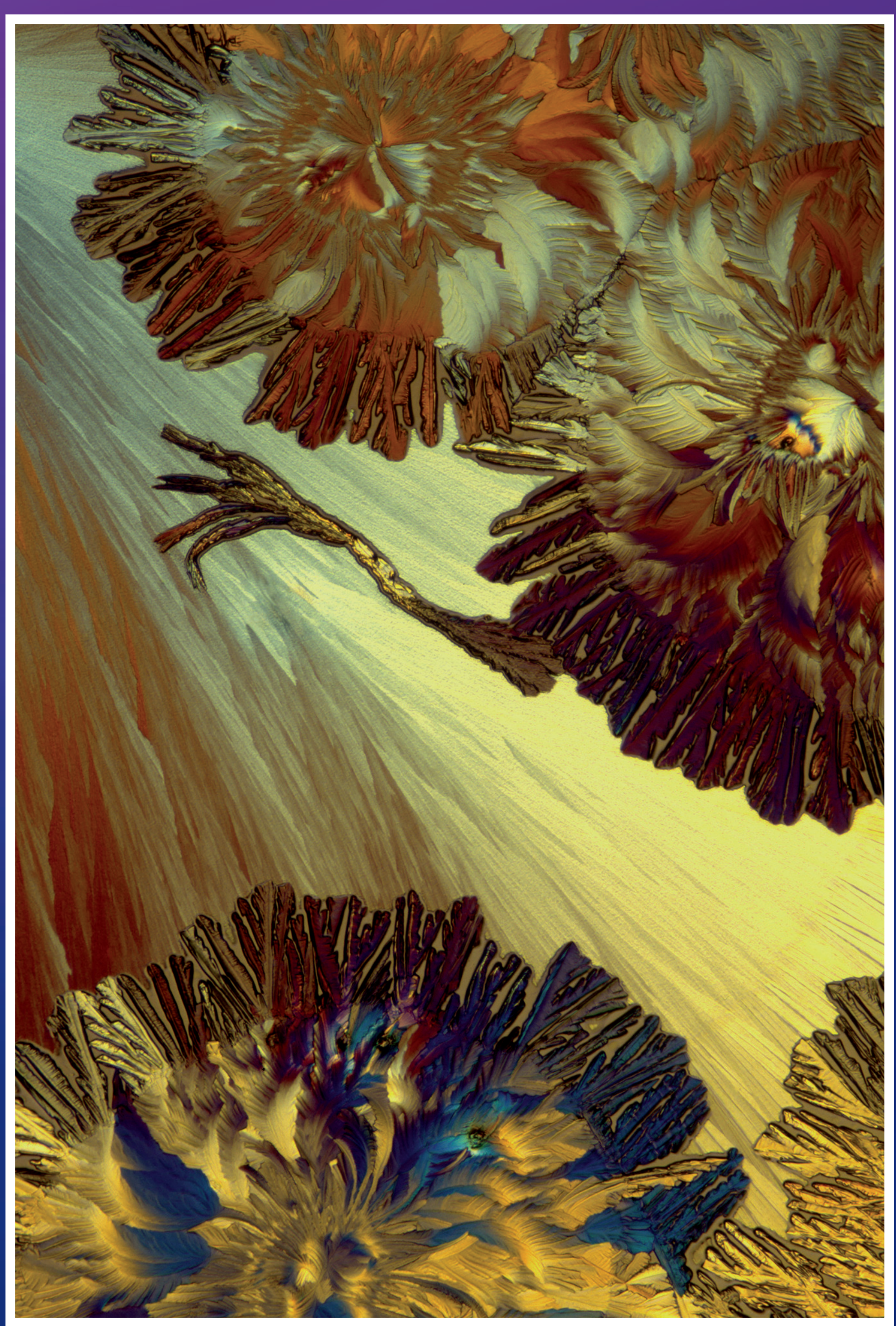
Crystallisation is based on a simple principle: forming a solid object with atoms that are organised in a periodic array. This organisation is spontaneous but **time must be allowed for it to take place** and that time varies according to the crystals you are trying to grow.

Take your time to make large crystals

When a molten compound is suddenly cooled (quenched) there is no long-range order of the positions of atoms (amorphous glass) as there was in the molten state. If cooling is sufficiently "slow", then the atoms and molecules have time to move and thus optimise their interactions and compactness. These two factors lead to an atomic order which is regularly repeated, and which will be propagated to new molecules/atoms joining those already solidified. Each atomic "layer" reproduces the order of the inner layer and acts as a model or "pattern" for the following ones.

The period of time may vary considerably according to each material. If you want to grow a few large crystals instead of many small crystals, you'll need more time!

Synthetic quartz crystals. Source : Coll. LMGP-Grenoble-INP



Recrystallization of citric acid viewed under polarized light.
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Synthetic sapphires and rubies
These crystals are made by the flame fusion method, a process developed by **Verneuil** in 1902, or by crystal pulling. In addition to jewelry, these crystals are mainly used for their hardness in watchmaking (scratchproof glasses for luxury watches) as well as for their physical and thermal properties in industrial applications
© Coll. RSA Ruby

Surface of a biological crystal showing stacking faults as seen by atomic force microscopy . © IUCr – journals

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