What is a crystal? From a chemist's point of view, it is a solid with long-range order!

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Like many other scientists in chemistry, my co-workers and I regularly use diffraction methods to characterize new compounds and materials. In this context, the definition of a crystal as *"...any solid having an essentially discrete diffraction diagram..."* [1] seems satisfactory and convenient.
Like many other scientists, I am involved in teaching. My didactic commitment is not limited to specialized workshops in single crystal diffraction for PhD candidates but also includes general chemistry lectures. I am expected to explain the concept of a crystal to first-year chemists, material scientists and physicists. Decades ago, my academic teachers could honestly refer to the ideas of *periodicity* and *unit cell*. The situation has changed: In the meantime, aperiodic ordered solids have been well documented. Most of us will agree that a teacher should not stick to an outdated definition just because it is simple. I usually tackle the issue with a statement about long-range positional order and then extend it: *"One popular way of creating solids with long-range order is associated with 3D translation; other types of ordering are possible and have been observed..."* Obviously, the content and ambition of this extension will depend on the audience.
The idea of a crystal as a solid with long-range order comprises the plethora of substances covered by the earlier, periodicity-based definition as a special subset. This relationship helps to encourage scientific curiosity among those students or non-experts who aim at a more complete understanding and is comforting for all those who once learned the earlier definition and now have to accept that there is something beyond. The concept of long-range order does not require knowledge about diffraction and hence allows to communicate the definition of a crystal to a broader public.
Like many other people, my seven-year old daughter is attracted by the beauty of crystals – minerals, photographs of molecular and protein crystals, and of course her self-grown copper sulfate and alum species. Telling her that the outer appearance of these objects is related to their internal order is admittedly pretty vague. It surely represents an incomplete statement which calls for further explanations about bonding and interactions but it has the advantage of being both simple and true.

References

[1] IUCr: Report of the Executive Committee for 1991. Acta Crystallogr. A**48** (1992) 922-946.

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