

# **Crystal growth mechanisms in biomineralization: Solution mediated growth versus amorphous precursor nanoparticle-mediated accretion**

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One of the most significant recent realizations in biomineralization concerns crystal formation mechanisms involving intra-cellular deposition of transient amorphous precursor phases. The initial observations on chiton teeth that were considered a singular curiosity appear now to be the norm. In cases where the precursor phases were imaged, they were seen to consist of nanosphere particles. Interestingly, some mature biogenic crystals also have bulk textures consisting of nanosphere particles, suggesting that the crystalline material preserves a memory of the precursor phase. Some crystals are delimited by crystallographic faces that appear smooth at the microscopic level, but are composed of nanospheres at the nanometer scale, whereas others are smooth even at the nanometer level. We use these morphological observations to integrate several biogenic crystal formation processes, although by no means all of them, within a general mechanistic framework: growth by nanosphere particle accretion is predominant in some cases, with amorphous nanoparticles being incorporated as such into growing crystals and preserved upon crystallization; solution-mediated ion-by-ion growth typifies other biomineralization processes, and some cases involve both processes. Outstanding questions concern the phase of the initial transient amorphous deposits and the processes generating them.

[1] Gal et al (2015) *CrystEngComm* **17**, 2606 – 2615