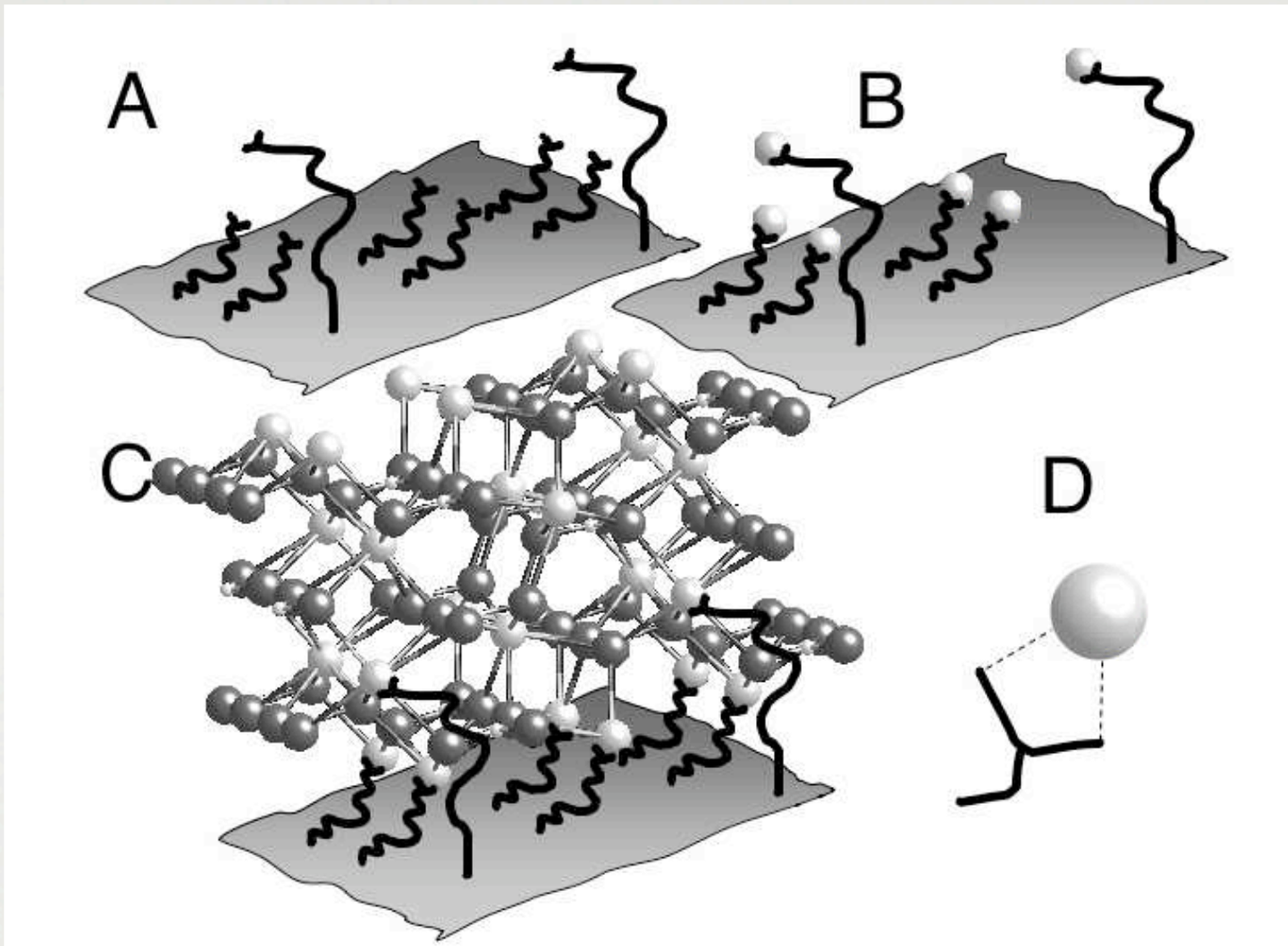

Figure 3. Paradigm for the epitaxial overgrowth, or templation, mechanism in biomineralization. The organic matrix (A) is composed of macromolecules, which depending on the particular biomineral may include a single organic molecule, e.g., a polysaccharide or a complex arrangement of proteins and glycoproteins. In all cases the organic components have charged functional groups that attract ions from solution (B). The steric arrangement of organic macromolecules, their sequence, and folding determines the precise position in three dimensions of the ions. Such positions are only compatible with a specific mineral, even more: they are only compatible with a well-determined polymorph of a specific mineral (C). The crystal structure shown (C) is aragonite, the large white ions in (B) are Ca^{2+}, while the small-white and large-dark atoms are C and O, respectively in (C). (D) Zooming in on the organic-mineral interface: the inter-atomic bonds are indicated by dashed lines. A similar mechanism of epitaxial overgrowth takes place in many matrix-mediated eukaryotic and some biologically induced prokaryotic biomineralization mechanisms.