Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.5334

Biomineralization of barnacle base plate in association with adhesive cement protein

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The adhesive layer underneath the acorn barnacle *Megabalanus rosa (Mr)* is an attracting bioinspired system of both biomineralization and biological adhesive due to its functional roles at the interface adjacent to both the barnacle's own calcareous base plate and the external substrate which it adheres to. Growth of the barnacle includes expanding its base plate and periphery shell by molting and calcification, and at the same time secreting the adhesive proteins[1]. Nano- and micro-crystalline $CaCO_3$ of the base plate[2], as well as the 3D structure of the adhesive protein "Mr20" [3] have been studied so far, but detailed mechanisms of their interplay occurring at the submerged interface is yet unclear. Our work aims to understand how Mr20 may regulate calcium carbonate crystallization of the base plate, by studying: (1) protein-mediated crystal growth kinetics and morphology; and (2) the restructuring of the flexible Mr20 in the presence of mineral ions and during mineralization. The results demonstrate a mutual influence between the protein and mineral growth, which support a recent molecular dynamic modelling of their interplay [4]. This research brings insights into understanding the multifunctional roles of barnacle's adhesive protein underneath the base plate, and provides biomimetic lessons for the development of new bioinspired adhesives.

References:

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