MARINE BIOADHESION FROM THE SEA TO THE BENCH – THE CASE OF SEA URCHINS

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Résumé

Bioadhesives (e.g., surgical adhesives) have revolutionized biomedicine and biotechnology in the last few years. However, few combine lack of cytotoxicity and efficacy in wet/humid environments, two essential requirements for today's bioadhesives. In contrast, in Nature, several marine invertebrates are known to attach to different substrates in the presence of seawater (which has a high dielectric and ionic strength similar to physiological fluids) through the production of biocompatible adhesive secretions. Although some of these marine adhesives have already inspired the development of new biomimetic adhesives, there is a growing need for new adhesive systems with novel capabilities. Considering that sea urchin bioadhesives display an adhesion strength of up to 0.5 MPa (in comparison to 0.2 MPa for the commercially available. fibrin glue), this animal has become an ideal model to develop new bioinspired adhesives (1).

Extensive molecular and mechanical characterization of sea urchin glue allowed to pinpoint several adhesive protein candidates based on their expression levels, localization and presence of known adhesion-related domains (2,3,4). One of them, Nectin-2 (UniProt A0A182BBB6) which contains six galactose-binding discoidin-like domains (thought to be important for its adhesive function), was selected for further investigation with a view to application. Our group was able to successfully produce and characterize the first sea urchin inspired recombinant protein, SUNectin. We obtained a folded and stable protein suitable for large scale production and testing of adhesive features.

From the sea to the bench, this project contributes to the development of more nature-inspired bioadhesives for biomedical/biotechnological applications.

Mots-Clés: Biomimicry, biotechnology, marine bioadhesion, sea urchins, bioadhesives

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