Characterization study of adhesive proteins from *Bathymodiolus azoricus* mussel from deep-sea hydrothermal vents

F. Carneiro[1,2], R. Bettencourt[1,2], R.L. Reis[1,2,3], T.H.Silva[1,2]

[1]3B's Research Group, I3Bs – Research Institute on Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, AvePark, Parque de Ciência e Tecnologia, Zona Industrial da Gandra, 4805-017 Barco, Guimarães, Portugal;

[2]ICVS/3B's–PT Government Associate Laboratory, Braga/Guimarães, Portugal;

[3] The Discoveries Centre for Regenerative and Precision Medicine, Headquarters at University of Minho, Avepark, 4805-017 Barco, Guimarães, Portugal;

INTRODUCTION

Marine mussels are able to anchor to foreign surfaces, in seawater, through the use of adhesive proteins, the **mussel foot proteins (Mfps).** Mfps are known to form adhesive plaques with high interfacial binding strength, durability and toughness. One of the main constituents of Mfps is 3,4-Dihydroxyphenylalanine (DOPA)[1], that allows several types of chemical interactions and crosslinking, which results in the ability of Mfps to solidify in situ and bind tightly to various types of surface substrates[2]. Due to these remarkable wet adhesive properties, several natural Mfps have been extracted and analyzed from different species of mussels[3] aiming at the creation of adhesive materials.

Bathymodiolus azoricus mussel subsists at vent sites, amid unusual levels of heavy metals, pH, temperature, CO_2, methane and sulfide, while coping successfully with environmental microbes[4]. These conditions require unique anatomical and physiological adaptations to extreme environments. So, one hypothesize that adhesive proteins of *Bathymodiolus azoricus* might show different properties in comparison with homologous proteins from shallow water mussels.

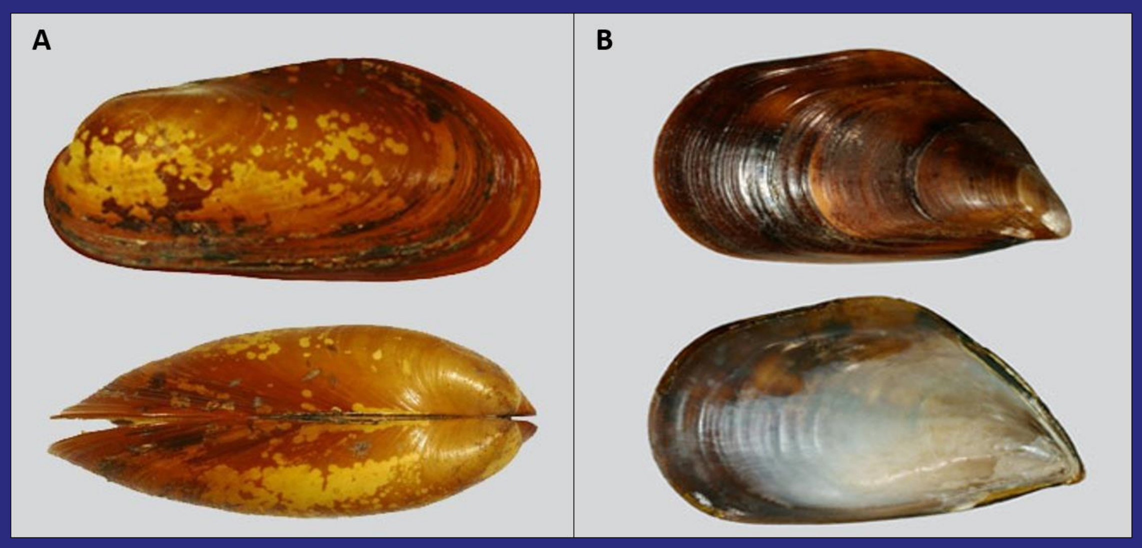


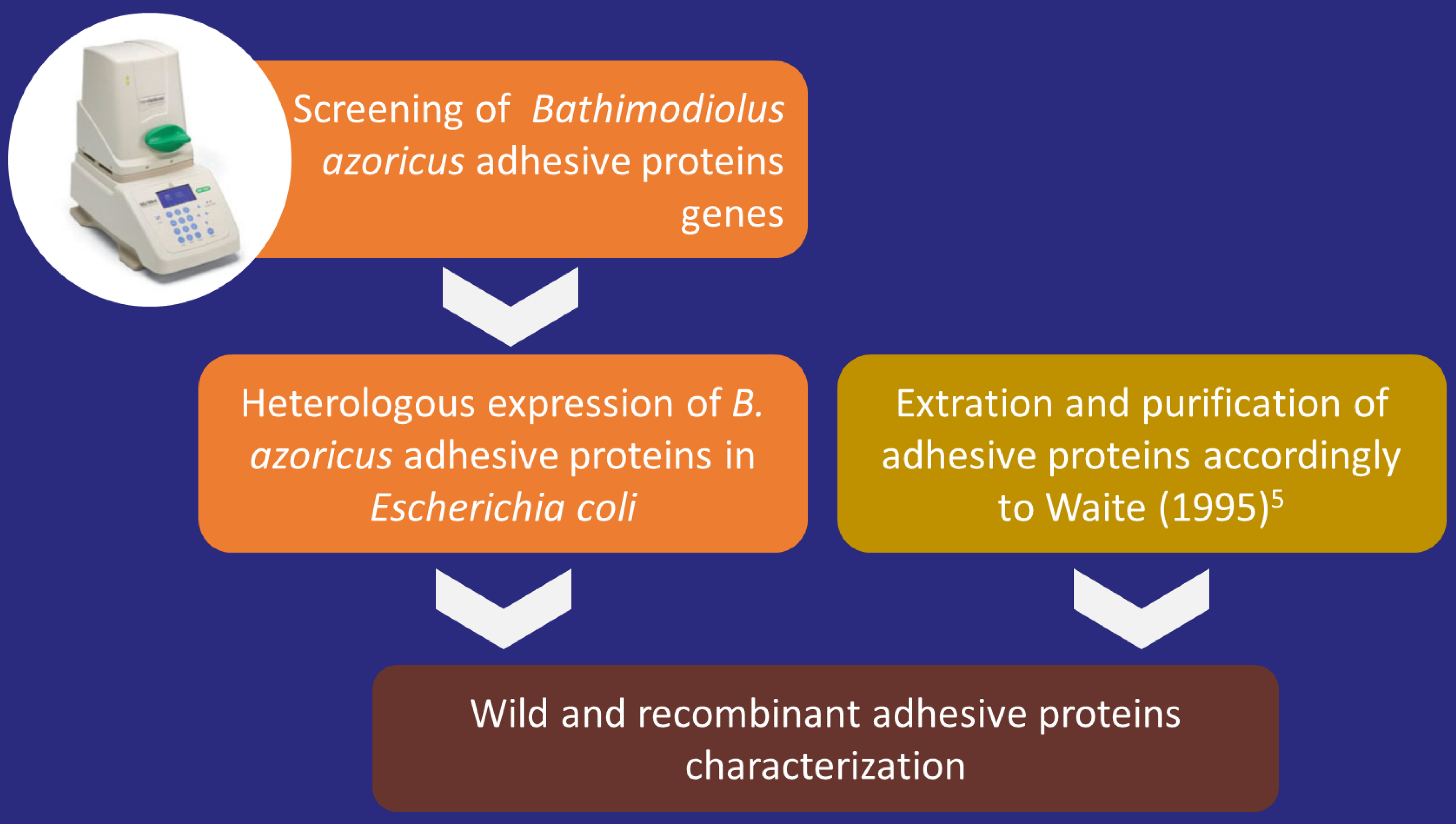
Fig. 1 – Mussels representation of A- *Bathymodiolus azoricus* and B - *Mytilus galloprovincialis.* *(Images adapted from* Natural History Museum Rotterdam)

AIMS

In this project, we propose the identification and characterization of adhesive proteins from the deep sea hydrothermal vent mussel *Bathymodiolus azoricus* following a genomics-based approach and further compare the obtained results with the already described adhesive proteins and coding gene sequences from other marine mussels including *Mytilus galloprovincialis.* Furthermore, we aim to produce recombinant adhesive proteins inspired on adhesive proteins of *B. azoricus*..

METHODOLOGY

In order to identify and characterize Mussel foot proteins (Mfp) from *Bathymodiolus azoricus,* the methodology illustrated in the scheme bellow is used, corresponding to a genomic-based approach.



Characterizatiion of Adhesive proteins:

- DSC (Differential Scanning Calorimetry);
- Amino Acid Analysis;
- CD (Circular Dichroism);
- SDS-PAGE;
- FTIR (Fourier Transform Infrared Spectroscopy).

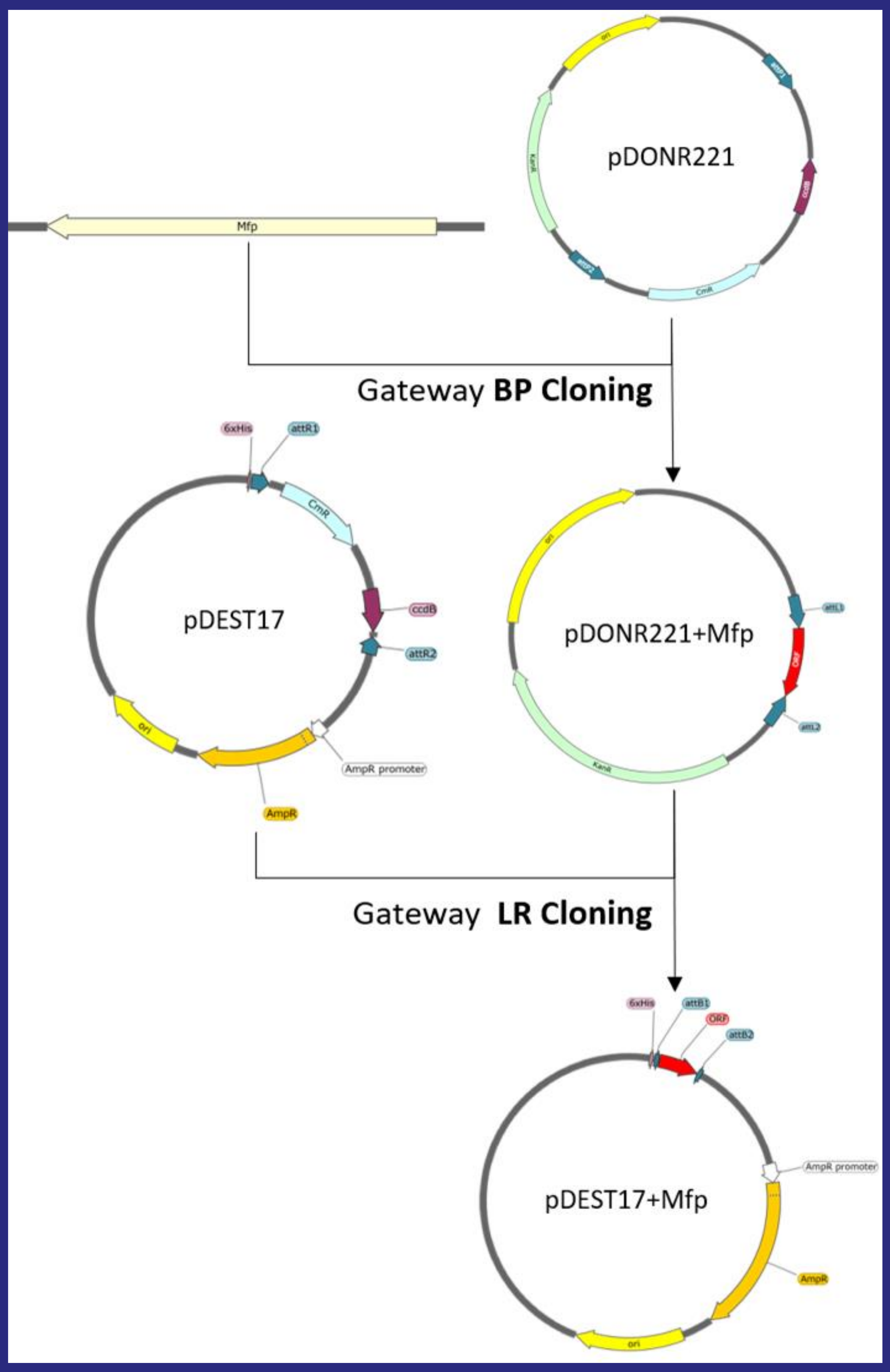


Fig. 2 - Representation of the cloning aproach to express heterologously *B.azoricus* Mfps. Cloning strategy will be performed accordingly to Gateway Technology[6] from Invitrogen. pDONR221+Mfp as entry clone. pDEST17+Mfp as expression clone.

FUTURE PERSPECTIVE

- *-Bathymodiolus azoricus* adhesive proteins might have the capacity to enhance the properties of biomaterials in tissue engineering context, namely by improving their interaction with components of the extracellular matrix in skin regeneration and healing processes.
- The produced knowledge might be relevant for biomedical applications, due to design of innovative bioadhesives, as surgical glues, and drug carriers for therapeutic uses.

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