# Marine sponges as product sources: Versatile and sustainable – The case of *Aplysina aerophoba*

Meschke, S.,[1] Bürger, M.,[1] Ehrlich, A.,[1] Bazhenov, V.,[2] Ehrlich, H.[2]

[1] BromMarin GmbH, Wernerstraße 1, 09599 Freiberg

stephan.meschke@brommarin.de, marcel.buerger@brommarin.de

[2] Institute of Experimental Physics, TU Bergakademie Freiberg, 09596 Freiberg

## Introduction

Marine sponges constitute a marine renewable resource with little to no industrial exploitation at present. In the case of *Aplysina aerophoba*, a novel extraction method was developed, to unfold the dual potential of the sponge. First, marine secondary metabolites – above all Aeroplysinin-1 – show promising cytotoxic, antibacterial, and anti-fouling effects [1]. Second, the in 2007 discovered chitinous scaffold [2] is featured as biocompatible, biodegradable and bioactive with a 3D adsorptive structure. Thus, the industrial usage of these two natural products ranges from pharmacy and cosmeceuticals to tissue engineering and material science. Aquaculture paths the way to provide the industry the sponge resource in a sustainable as well as cost efficient manner. For *A. aerophoba*, initial investigation in the Mediterranean are highly promising. Further, positive environmental impact by sponge farming is to be expected [3]. Summarizing, the transfer of scientific results into practical applications in the sponge area is overdue, providing versatile natural products in a sustainable manner and positively influencing the marine habitat.

## Principal novelty

In contrast to other demosponges, the representatives of Verongida order produce their secondary metabolites like bromotyrosines using highly specialized cells named spherulocytes (Fig.1) [4]. These cells are localized within skeletal fibres which are made of α-chitin. The biological reason of this phenomenon is clear: bromotyrosines are inhibitors of chitinases.

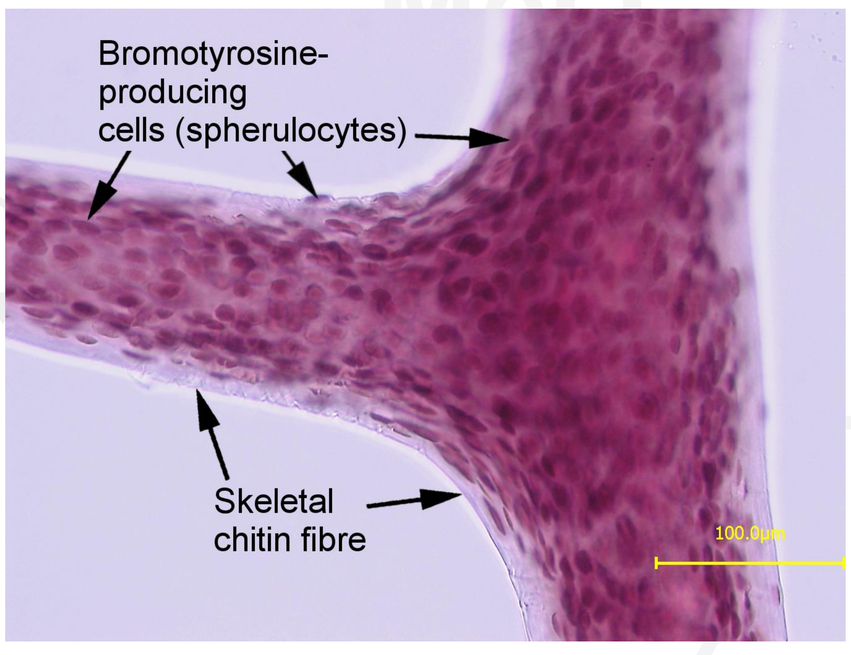



Fig. 1: Light microscopy image of the chitinous skeletal fibre with bromotyrosine-producing cells (Verongida order).

## Our strategy

We developed a novel extraction procedure that allows to extract both bromotyrosines and pure chitin with 99% yield (Fig.2)

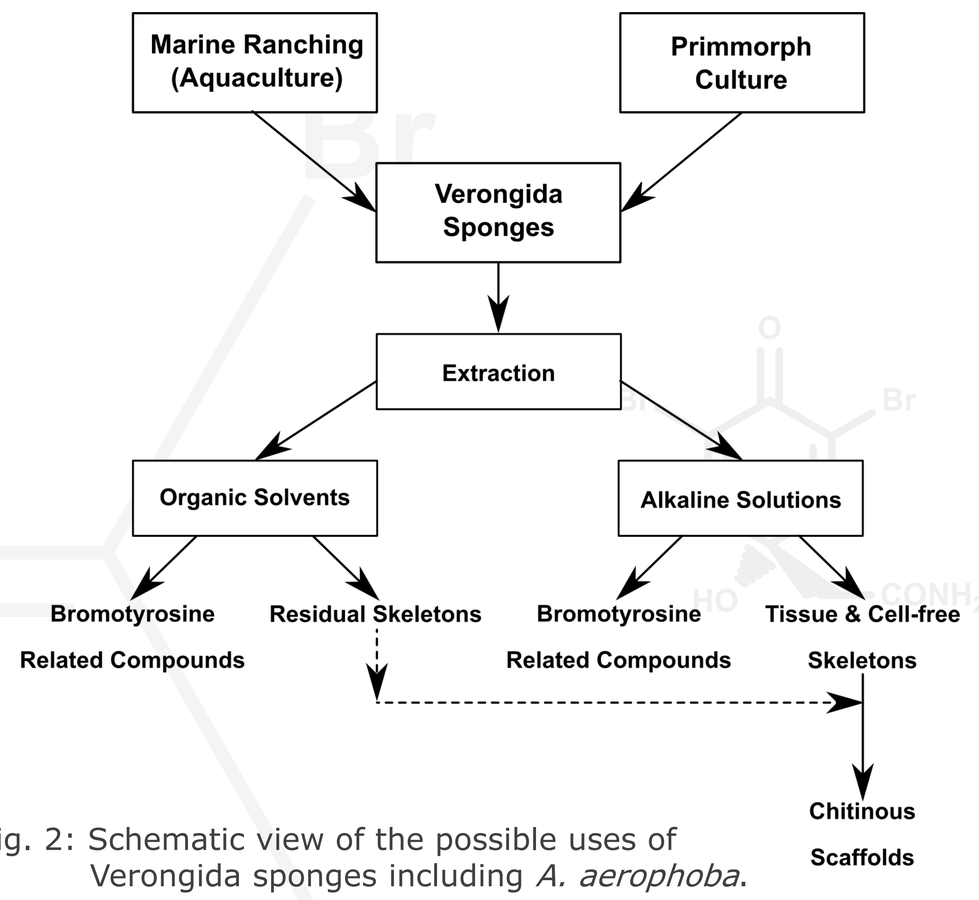
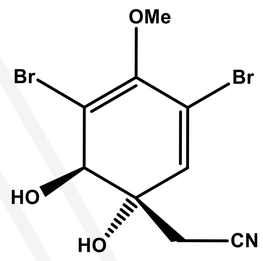



Fig. 2: Schematic view of the possible uses of Verongida sponges including *A. aerophoba*.

## Bioactivity of Aeroplysinin-1




The bromotyrosine derivate Aeroplysinin-1 is known for its manifold effects. Anyhow, promising bioactivities remain yet enclosed.

### Antibacterial effects

- effects on selected pathogens: *C. difficile, MRSA, E. faecalis*

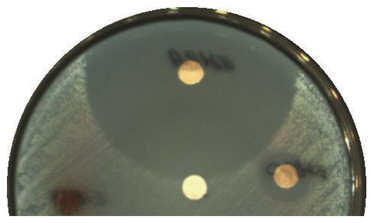


Fig. 3: Pathogen – *Clostridium difficile*

### Cytotoxic effects

- $IC_{50}$-value: 0.65 µg/ml-6.5 µg/ml

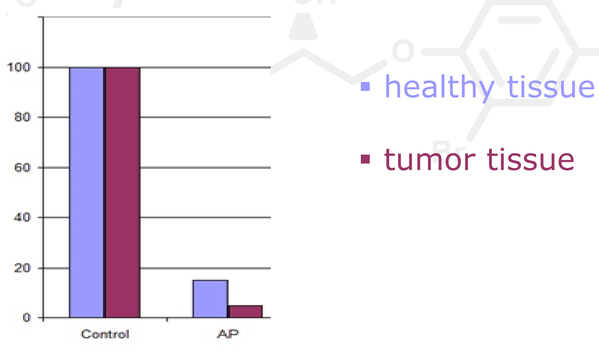



Fig. 4: Cell line – mouse tissue MEF melanoma - B16F10

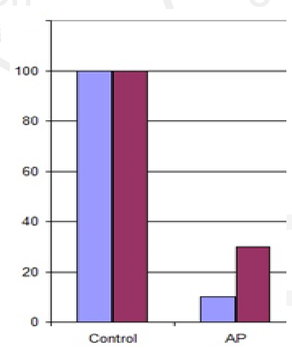
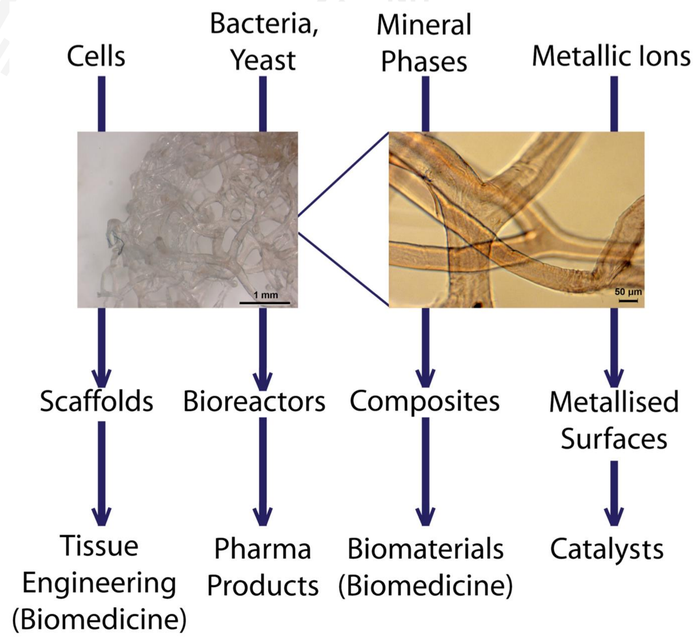



Fig. 5: Cell line – human tissue HEF1698 melanoma - MeWo

## Sponge chitin

Apart from the biomedical applications, the material properties of chitin open the perspective to use the scaffolds as a support, e. g., for metals in order to produce catalysts. In summary, it can be stated that Verongida sponges including their skeletons may be a natural resource for the production of diverse products in a biomimetic manner.




Further reading: Patent: WO2011023531 A2
Ehrlich et. al. (2011) Two or three-dimensional cleaned chitin skeleton of dictyoceratid sponges, method for the production and use thereof

## References

[1] Martínez-Poveda, B. et al., PLOS ONE 2013; 8:1-10.

[2] Ehrlich, H. et al., J. Exp. Zool. 2007; 4:473-483.

[3] Fu, W. et al., Biotechnol. Bioneg. 2007; 97:1387-1397.

[4] Vacelet, J., J. Microscopie 1967, 6:237-240.

Biotech Symposium 2015
GEOMAR