A simple method developed for 3-D bio-fabrication based on bacterial cellulose

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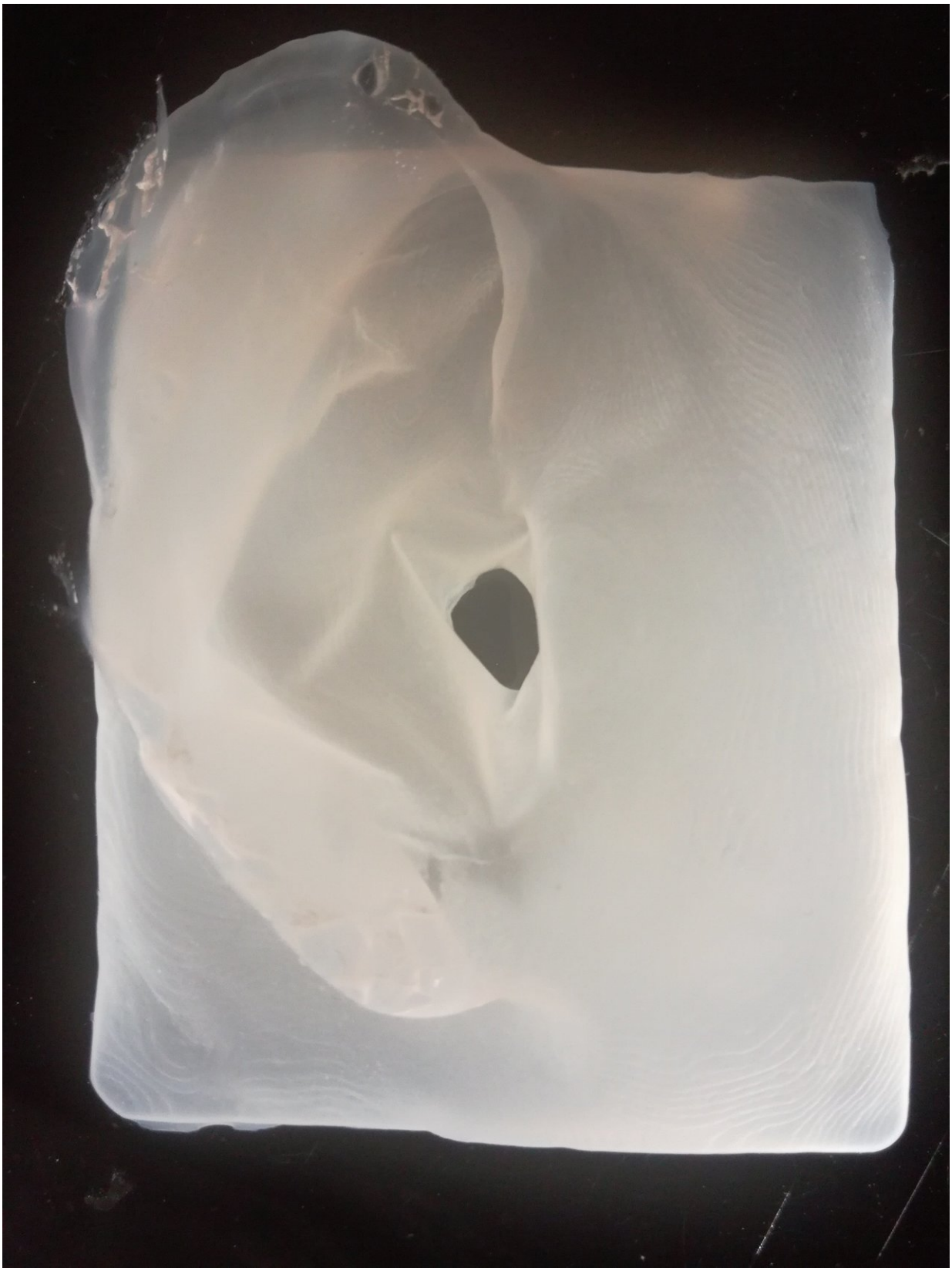

Bacterial cellulose bio-fabricated in the shape of an ear via superhydrophobized molding. Credit: Luiz G. Greca

Bacterial cellulose (BC) nanofibers are promising building blocks for the development of sustainable materials with the potential to outperform conventional synthetic materials. BC, one of the purest forms of nanocellulose, is produced at the interface between the culture medium and air, where the aerobic bacteria have access to oxygen. Biocompatibility, biodegradability, high thermal stability and mechanical strength are some of the unique properties that facilitate BC adoption in food, cosmetics and biomedical applications including tissue regeneration, implants, wound dressing, burn treatment and artificial blood vessels.

In the study published in *Materials Horizons* researchers at Aalto University have developed a simple and customizable process that uses superhydrophobic interfaces to finely engineer the bacteria access to oxygen in three dimensions and in multiple length scales, resulting in hollow, seamless, nanocellulose-based pre-determined objects.

"The developed process is an easy and accessible platform for 3-D biofabrication that we demonstrated for the synthesis of geometries with excellent fidelity. Fabrication of hollow and complex objects was made possible. Interesting functions were enabled via multi-compartmentalization and encapsulation. For example, we tested in situ loading of functional particles or enzymes with metal organic frameworks, metal nanoparticles with plasmon adsorption, and capsule-in-capsule systems with thermal and chemical resistance", explains Professor Orlando Rojas.

This facilitated biofabrication can be explored in new ways by the

biomedical field through scaffolding of artificial organs. Advances in bioengineering, for instance by genome editing or co-culture of microorganisms, might also allow further progress towards the simplified formation of composite materials of highly controlled composition, properties and functions.

More information: Luiz G. Greca et al. Biofabrication of multifunctional nanocellulosic 3D structures: a facile and customizable route, *Materials Horizons* (2018). DOI: 10.1039/C7MH01139C

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