Meta-biomaterials

Amir A Zadpoor[1]

[1]Department of Biomechanical Engineering, Delft University of Technology
a.a.zadpoor@tudelft.nl

Metamaterials have emerged as promising candidates for creating advanced functionalities thorough adjustment of their mechanical, electromagnetic, or acoustic properties. The properties and, thus, functionalities of metamaterials are direct consequences of their small-scale architecture. Given the fact that design of arbitrarily complex micro-architectures is crucial for creating properties and functionalities, the advances made in additive manufacturing (3D printing) techniques are of particular relevance to the design and manufacturing of metamaterials. For biomedical applications, this creates a great opportunity to develop porous biomaterials with unprecedented combinations of mechanical, mass transport (permeability, diffusivity), and biological properties. Additively manufactured porous biomaterials are, however, very limited in terms of the surface access they allow, meaning that surface-related functionalities cannot be easily added to such biomaterials. Starting from a flat shape and folding the porous biomaterials up using origami techniques is a solution that allows for fabrication of porous biomaterials that combine properties originating from their 3D porous structure with those stemming from surface features (e.g. surface nanopatterns). In this talk, I will present an overview of the research carried out in my lab that has led to introducing the concept of meta-biomaterials and will discuss how meta-biomaterials could be used to improve bone tissue regeneration and prevent biomaterials-associated infections.

A part of the research for this paper was financially supported by the Prosperos project, funded by the Interreg VA Flanders – The Netherlands program, CCI grant no. 2014TC16RFCB046.