Harnessing proteins and supramolecular events to build advanced biomaterials

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Abstract

Nature has evolved to grow and heal materials and tissues through self-assembling processes capable of organizing a wide variety of molecular building-blocks at multiple size scales. While advances in fields such as nanotechnology and biofabrication are enhancing our capacity to emulate some of these biological structures, it is increasingly evident that recreation of the complexity and functionality of living systems will require new ways to build with proteins. This talk will present our laboratory's efforts to harness supramolecular events found in nature such as multicomponent self-assembly, protein order-disorder synergies, and diffusion-reaction processes to engineer advanced protein-based materials. The resulting materials exhibit properties such as hierarchical organization[1-3], the capacity to grow and heal[2,3], tuneable mechanical properties[1,2], and spatially controlled bioactivity[4,5].

References

1. Elsharkawy et al (2018). Nature Communications, 10.1038/s41467-018-04319-0.
2. Wu et al (2020). Nature Communications, 1182, 10.1038/s41467-020-14716-z.
3. Inostroza-Brito et al (2015). Nature Chemistry, 10.1038/nchem.2349.
4. Hedegaard et al (2018). Advanced Functional Materials, 10.1002/adfm.201703716.
5. Hedegaard et al (2020). Science Advances, 10.1126/sciadv.abb3298.

Biography

Alvaro Mata is Professor in Biomedical Engineering and Biomaterials in the School of Pharmacy and the Department of Chemical and Environmental Engineering at the University of Nottingham. He holds a Bachelor's Degree from the University of Kansas, a Master's Degree from the University of Strathclyde, and a Doctor of Engineering Degree from Cleveland State University working with Prof. Shuvo Roy at the Cleveland Clinic. He conducted his postdoctoral training with Prof. Samuel Stupp at Northwestern University. His group focuses on developing innovative ways to build with biomolecules to engineer active, hierarchical, and living materials that can recreate complex biological environments. Before joining the University of Nottingham, he helped established and served as Director of the Institute of Bioengineering at Queen Mary University of London between 2015-2018 and is now the Chair of the Manufacturing Commercial and Regulatory Committee of the UK Regenerative Medicine Platform (UKRMP2) – Acellular / Smart Materials – 3D Architecture Hub. His work has led to seven patents or patent applications; publications in journals including Nature Chemistry, Nature Communications, Science Advances, and Advanced Functional Materials; and awards such as a Ramon y Cajal Fellowship and an ERC Staring Grant.