

S003 Enzymatically ordering the nanoworld
**RJ Williams¹, C Tang¹, K Thornton¹, S Toledano¹,
AM Smith¹, A Hirst¹, M Hughes², AK Das², RV Ulijn^{1,2}**
*(1) Manchester Interdisciplinary Biocentre & School
of Materials, The University of Manchester, UK.; (2)
WestCHEM, The University of Strathclyde, Glasgow, UK;*

Self-assembly (SA) as an approach to produce functional molecular architectures is commonplace in biology. Despite significant advances it is still a major challenge to achieve similar control and complexity in the laboratory. Self-assembled structures that are reproducible and virtually defect-free are of interest for applications in 3D cell culture, templating, biosensing and supramolecular electronics. In this talk we will discuss the use of fully reversible enzyme catalysed reactions to drive SA. In this approach, molecular SA of aromatic short peptide derivatives provides a thermodynamic driving force that enables a protease to produce building blocks in a reversible and spatially confined manner. We demonstrate that this system uniquely combines three features: (i) self-correction: fully reversible SA under thermodynamic control, (ii) component-selection: the ability to amplify the most stable molecular SA structures in dynamic combinatorial libraries, (iii) spatiotemporal confinement of nucleation and structure growth. Enzyme-assisted SA therefore provides unprecedented control in bottom-up fabrication of nanomaterials, ultimately paving the way to functional nanostructures with enhanced complexities and fewer defects. Applications in biomedicine and nanotechnology will be discussed.