BRISTOL CENTRE FOR FUNCTIONAL NANOMATERIALS

University of BRISTOL

Bristol – JILIN Symposium: October 2018

Abstract Submission Form

Name (including title):	**Dr Annela Seddon**
Email address:	**Annela.seddon@bristol.ac.uk**

Brief description of research activities:

Research in the Seddon group looks at science at the interface between Physics, Biology and Engineering and focus mainly on how the shape of soft materials inspired by nature, and their transformations across the length scales can be used to understand and design better materials. In particular, scattering techniques including small angle x-ray and neutron scattering are used to probe nanoscale structure.

Presentation title:

Ordering of Soft Matter: What X-ray Scattering of Amphiphiles tells us about Protein Crystallization, Electroactive Amphiphiles and Air Pollution.

Presentation abstract:

Understanding and characterising the self-assembly behaviour of biological amphiphiles such as the lipids that make up the cell membrane is commonly achieved by using small-angle x-ray scattering (SAXS) to measure the size, shape and types of structure formed by these molecules. However, whilst ordered on the nanoscale, often these materials have no preferred orientation in the bulk, and exist as a collection of nano- to microscopic domains, which can greatly influence their properties. In our work, we demonstrate a method based around controlled dilution under shear to create "single-crystal" like structures of soft materials, and show how these can be applied to solve biological problems such as membrane protein crystallization [1-3]. We have extended the range of lipid compositions which can form these structures and show that by tailoring the addition of small molecules, we can create size-tunable lipid structures with controllable properties such as charge. We have taken also taken this method and applied this to the production of ordered 3D arrays of electroactive surfactants [4]. More recent work has shown how x-ray scattering of these materials using acoustic levitation sheds light on the organisation of amphiphiles at the air-water interface [5] and how this may be used to better understand the role of small amphiphiles in environmental air pollution [6].

Selected publications:

[1] A highly oriented cubic phase formed by lipids under shear, Seddon AM, Lotze G, Plivelic TS and Squires AM, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, 2011, 133, 13860-13863

[2] Preparation of films of a highly aligned lipid cubic phase, Squires AM, Hallett JE, Beddoes CM, Plivelic TS and Seddon AM, LANGMUIR, 2013, 29, 1726-1731

[3] Experimental confirmation of transformation pathways between inverse double diamond and gyroid cubics, Seddon AM, Hallett JE, Beddoes CM, Plivelic TS and Squires AM, LANGMUIR, 2014, 30, 5705-5710

[4] Self-Assembly of a Functional Oligo(Aniline)-Based Amphiphile into Helical Conductive Nanowires, Bell, OA, Wu, GL, Haataja, JS, Brommel, F, Fey, N Seddon AM, Harniman, RL Richardson, RM, Ikkala, O, Zhang, X, Faul C, 2015, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, 14288-14294

[5] Control of Nanomaterial Self-Assembly in Ultrasonically Levitated Droplets Seddon, A., Squires, A., Pfrang, C., Richardson, S., Rastogi, K. & Plivelic, T. JOURNAL OF PHYSICAL CHEMISTRY LETTERS. 2016, 7, 7, 1341-1345

[6] Complex three-dimensional self-assembly in proxies for atmospheric aerosols Pfrang C., Rastogi K., Cabrera-Martinez, ER.,. Seddon AM., Dicko C., Labrador A., Plivelic TS., Cowieson N., Squires AM., NATURE COMMUNICATIONS, 2017, 1724