Exploring and exploiting amyloid architectures for biomedical and nanomaterials applications

Virtually all proteins and peptides have the latent ability to self-assemble into filamentous nanostructures called amyloid fibrils. The well-known cross-beta structure of amyloid consists of repeating arrays of hydrogen bonded beta-strands, with the peptide molecules aligned perpendicular to the long axis of the fibrils. A small number of proteins can self-associate under physiological conditions and many of these are associated with debilitating diseases, including Alzheimer's, Parkinson's and type 2 diabetes. Much has been discovered in the past five years about the molecular architectures of amyloid fibrils, but how can we now use this information constructively? In our work we are developing solid-state NMR methods alongside other analytical techniques to elucidate the key structural elements that drive and stabilise amyloid assemblies. The knowledge gained is helping us to devise agents that prevent or modify aggregation into pathogenic species, and is inspiring the design of new nanomaterials that can be functionalised in a controlled manner. My talk will highlight some of the methods for determining the molecular organisation within fibrils and prefibrillar intermediates, and will demonstrate how structural data at the atomic level can be translated into potentially useful new materials.

==========

David A. Middleton
School of Biological Sciences
University of Liverpool
Crown Street
Liverpool L69 7ZB
U.K.