

Aisha N. Bismillah

Royal Commission for the Exhibition of 1851 - Ramsay Memorial
Trust Research Fellow



Friday, June 27th

2:00pm - 3:00pm

Steele 006

"Controlling Bistable Dynamic Shapeshifting Systems"

Abstract: Stereogenic sp^3 -hybridised carbon centres are fundamental building blocks of chiral molecules. Unlike dynamic stereogenic motifs such as sp^3 -nitrogen centres or atropisomeric biaryls, sp^3 -carbon centres are usually fixed, requiring intermolecular reactions to undergo configurational change. Here, we report a series of chiral fluxional carbon cages¹ that exhibit responsive sp^3 -carbon-centered stereochemistry, adapting to and transmitting surrounding stereochemical information.² By analysing NMR spectra of solution, solid and powdered samples, X-ray crystal structures and DFT models, we observe that the sp^3 -carbon stereochemistry of the rigid tricyclic cages is inverted through strain-assisted Cope rearrangements, emulating the low-barrier configurational dynamics typical for sp^3 -nitrogen inversion or conformational isomerism. This dynamic enantiomerisation can be stopped, restarted, or slowed by external reagents, while the configuration of the cage is controlled by neighbouring, fixed stereogenic centres. As part of a phosphoramidite-olefin ligand, the fluxional cage acts as a conduit to transmit stereochemical information from the ligand while also transferring its dynamic properties to chiral-at-metal coordination environments (Figure 1), influencing catalysis, ion pairing and ligand exchange energetics.

Biography: Dr Aisha N. Bismillah is a Royal Commission for the Exhibition of 1851-Ramsay Memorial Trust Research Fellow at the Francis Crick Institute as well as the Department of Chemistry in Kings College London. She is a supramolecular and physical organic chemist investigating dynamic and switchable systems for applications in biomedicine, systems chemistry and energy storage. Aisha obtained her MChem degree in 2015 from the University of Central Lancashire, also completing three undergraduate summer research placements – one of which was in the USA. Following a summer in industry with Veolia, she joined the laboratory of Prof. Paul McGonigal at Durham University, gaining her PhD in 2020. During her PhD studies, Aisha completed an RSC-funded placement with Prof. Surya Prakash at the University of Southern California, USA. In 2019, she was subsequently awarded a prestigious US-UK Fulbright Scholarship to join Prof. Ivan Aprahamian's laboratory in the USA at Dartmouth College, which was followed by a return to the McGonigal group at the University of York in 2021 as a Leverhulme PDRA. Since October 2024, Aisha has been hosted by the McTernan group as an 1851-Ramsay Fellow.