The worldwide market for functional surfaces exceeds $100 billion per annum (US Department of Energy). A key driver is the added value that can be imparted to commercial products through the molecular engineering of their surface properties. For example, the cleanliness of optical lenses, the feel of fabrics, the resistance of biomedical devices to bacteria, the speed of computer hard disks, and even the wear of car brake pads are all governed by their surface properties. The fabrication of such surfaces requires the incorporation of specific functional groups; for which there exists no shortage of potential methods including: self-assembled monolayers (SAMs), Langmuir-Blodgett films, dip-coating, grafting, chemical vapour deposition, to name just a few. However such techniques suffer from drawbacks including substrate-specificity (cannot be easily adapted to different materials or geometries) and environmental concerns associated with the utilization of solvents, strong acid / base media, or heat. A range of innovative solutions will be described for the molecular tailoring of solid surfaces. Applications will include: super-repellency, non-fouling, anti-fogging, thermoresponsive, rewritable bioarrays, opto-chiral, antibacterial, electrical barrier, water harvesting, capture and release, oil-water separation, and nano-actuation. This research has led to 41 patent families and the establishment of
3 successful start-up companies: Surface Innovations Ltd, Dow Corning Plasma Ltd, and P2i Ltd (2015 International Business Award for 'Most Innovative Company in Europe').