Abstract STG: Cell membranes contain a large part of the delicate machinery of life and comprise the barriers controlling access to and from the interior of the cell. With the increasing use of nanoparticles (NPs) in medical imaging, drug delivery, cosmetics and materials the need is great and increasing to understand how NPs physically interact with cell membranes. On the one hand it is important to understand mechanisms to control risks of novel nanomaterials and to design therapeutic agents which can enter cells specifically and non-destructively. On the other hand, the structure and function of biological membranes inspire development of biomimetic smart materials for biotechnological applications which exploit or are modeled on biological membranes, but given enhanced functionality and external control of properties through incorporation of functional NPs.

The aim of the proposed work is to develop understanding of the biophysical interaction of functional NPs with lipid membranes, in particular NP incorporation into and penetration through lipid membranes. Further, the aim is, based on that knowledge, to understand and control the self-assembly of superparamagnetic NPs into synthetic and cell lipid membranes to actuate them and control their physical properties in pursuit of novel biomimetic smart materials and cell analytical methods.

The required level of control for this research has until recently been beyond the reach of existing NP systems (lack of synthetic control, stability and characterization) and methodology (lipid membrane models and high resolution techniques for their investigation). However, it can now be achieved using the Fe_3O_4 NP platform and surface-based and vesicular membrane model systems of tuned composition that I have developed. Using the same platform, breakthrough magneto-responsive biomimetic smart materials with application in drug delivery and cell manipulation with novel mechanisms of actuation will be self-assembled and investigated.