'Nanomachines controlling intracellular protein targeting, folding and assembly'

A universal event for the successful organisation and function of all cells is that proteins are able to be targeted to their correct location both spatially and temporally, as they often function in particular sites in the cell distant to where they are made. The magnitude of these targeting events is reflected by the fact that up to half of the cell's proteins (the proteome) are translocated across or inserted into a biomembrane. These processes are ensured by dedicated nano-molecular assemblies (translocation machineries) that help proteins negotiate the barrier of the lipid membrane. One of the most critical sites of extensive protein translocation across membranes occurs in mitochondria, the sites of cellular energy production in the form of ATP. Virtually all of the mitochondrial proteins (about one thousand different polypeptides) are imported from the cytosol and are then sorted within the organelle. We are using simple yeast cells as a model system to study these processes at three levels: (i) the whole organism (about 6,000 proteins), (ii) the isolated organelles (about 1,000 proteins) and (iii) individual molecules. We will present recent data on

(i) the structure/function of a novel class of chaperone molecules that facilitate targeting, folding and membrane integration of membrane proteins, and operate both in an aqueous environment and the lipid-water interface

(ii) the discovery of a novel oxidative folding mechanism that controls the assembly of these new membrane protein specific chaperones

(iii) the membrane integration of a protein subunit that controls self-assembly of the rotary molecular motor of the ATP synthase in the mitochondrial membrane