There is currently considerable interest in the cooling and manipulation of large molecules and even nanoscale to microscale objects. Of particular interest is cooling to the point where the quantum nature of the centre-of-mass motion becomes important and can be exploited. In this presentation I will describe our work in this rapidly evolving field. This includes the development of general methods to cool both simple and complex molecular species to microKelvin temperatures using sympathetic cooling, as well as trapping and cavity cooling of optically trapped nanoscale and microscale particles.