Magnetic nanostructures and the spin textures they may contain have attracted a great deal of attention in recent years. This interest is in part due to their potential utility in future low power data storage technologies. In this talk I will review our work on magnetic domain walls in single nanowires and nanowire networks. The structures we have studied are typically patterned using electron beam lithography and are fabricated from Permalloy (NiFe) or Cobalt (Co) having lateral dimensions on the order of 100nm and typical thicknesses close to 10nm. I will give details and results from the wide variety of measurement techniques that we have undertaken, including magneto-transport, magneto-optics, magnetic force microscopy, scanning transmission x-ray microscopy and x-ray photoelectron emission microscopy. Micromagnetic simulations have also been performed and often show very good agreement with the experimental results. I will describe our most recent work on magnetically frustrated hexagonal arrays often referred to as kagome or honeycomb ‘artificial spin ice’ structures. We have developed a new two layer ‘hybrid’ lattice in which the nanomagnetic elements are electrically connected, however are not directly magnetically connected. Comparing these structures to conventional artificial spin ice allows an assessment of the relative contributions from magnetic domain wall motion and from magnetostatic interactions. In addition to behaving as interesting analogues to ‘real’ bulk spin ice materials, these systems could have applications in new forms of computation such as neuromorphic or bioinspired computing.