One of the most ancient molecular machines in biology consists of a group of highly-conserved proteins that function to catalyze the assembly of iron-sulfur clusters in cells. We have used a combination of NMR spectroscopy, small-angle X-ray diffraction, calorimetry, and chemical crosslinking to investigate structure-function relationships among these proteins. In mitochondria, the protein frataxin has been found to be involved in the regulated delivery of iron to nascent iron-sulfur clusters.