Robert Coleman (The University of Queensland)

My project involves the study of biomineralisation processes, particularly the interactions of polyanionic macromolecules with the developing mineral phase. The nature of these interactions has not been conclusively established, thus simpler model polymers, synthesised by the reversible addition and fragmentation transfer (RAFT) method, are to be employed to study the possible interactions. More specifically, acid functionalised polymers with equivalent degrees of polymerisation and low polydispersity will be synthesised such that they vary solely by the functional group (carboxylate, phosphate, sulfate) or the degree of polymerisation. The effects of these well-defined polymers on the growth of hydroxyapatite can then be quantified.

Travel to The University of Sydney was undertaken in order to learn techniques in the synthesis and characterisation of RAFT polymers at the Key Centre for Polymer Colloids (KCPC) under the guidance of Assoc Prof Sebastien Perrier. During this visit, the polymerisation of the monomers hydroxyethyl acrylate (HEA), 2-carboxyethyl acrylate (CEA), and co-polymerisation of these, was performed using the RAFT process. The techniques required for characterising these polymers, namely NMR (to determine the structure of the polymer) and GPC (to determine the molecular weight and polydispersities) were developed during this time.

It was found that polymers of HEA and CEA could be synthesised with similar molecular weights at approximately 5000 Da. The polydispersities were not found to rise above 1.2, demonstrating that the polymerizations were highly controlled. The polymers synthesised in this work will be tested for their effects on the growth rates of hydroxyapatite using seeded crystal growth studies. The morphologies of the resultant crystals will be analysed to determine whether binding of the polymer to specific surfaces of the crystal results in a change in crystal morphology.

I would like to thank ASBTE for the opportunity to collaborate with leading polymer researchers at KCPC, as the techniques learned during this time will be used throughout the remainder of the project and in future materials research.