Despite the ‘simple’ nature of the anucleate red blood cell (RBC), RBC abnormalities are a leading cause of morbidity and mortality in humans. Among the most common of these RBC abnormalities are hemoglobinopathies (e.g., Thalassemia) and enzymopathies (e.g., G6PD). While mouse models exist for these diseases, they do not fully model the human diseases due to inter-species differences. Moreover, using patient derived RBC to study the effects on normal RBC structure and function is also difficult as these cells already exhibit pathological changes and/or altered enzyme levels. One novel approach to studying the effects of both hemoglobinopathies and enzymopathies is the use of osmotically lysed and resealed normal human RBC (i.e., resealed RBC). Using this method, abnormal hemoglobins, enzymes or extracellular proteins or molecules (e.g., high m.w. iron chelators) can be efficiently inserted into normal human (or mouse, etc.) RBC. Importantly, control-resealed RBC exhibit both normal RBC structure and function and in vivo survival thus allowing the use of resealed RBC for studying the effects of the altered hemoglobins/enzymes/etc. on RBC structure, function and survival. Moreover, current commercial efforts are underway to utilized resealed RBC in the clinical treatment of cancer and, potentially, other human diseases.