DESCRIPTION (provided by applicant): Resurfacing of articular cartilage with cold stored osteochondral allografts is employed clinically for repair of trauma and osteoarthritis-induced articular cartilage surface damage. Chondrocyte viability of transplanted articular cartilage is accepted as one of the determinants of outcome following osteochondral allograft transplantation. Refrigerated storage methods used for cartilage storage prior to clinical cartilage utilization need to be carefully evaluated because the tissue may be experiencing clinically significant deterioration during storage. We have recently investigated cartilage cell viability and matrix permeability during storage in culture medium, as well as storage solutions, and found that both deteriorate within the time frames that they are utilized for clinical procedures. Culture medium that preserves chondrocyte viability best under cold refrigerated storage conditions does not preserve matrix permeability and, vice versa, nutritionally deficient solutions that preserve matrix permeability have significantly less cell viability. This objective will be developed in three specific aims. In these aims two solution formulations, one based on intracellular and the other on extracellular milieu designs will be investigated. Chondrocyte viability, chemistry, biomaterial properties and gene expression will be compared over time during porcine cartilage storage. The gene expression studies will determine which formulation maintains normal untreated cartilage expression of Sox9, aggrecan, collagen type II (versus dedifferentiation marker collagen type I), cartilage oligomeric matrix, a matrix resorption marker plus protein and hypertrophic marker genes. The solution that provides the longest preservation of chondrocytes with a normal untreated chondrocyte phenotype with minimal if any cartilage biomaterial changes will be selected for further investigation in vivo and translation to human cartilage in a subsequent Phase II SBIR application. PUBLIC HEALTH RELEVANCE PUBLIC HEALTH RELEVANCE: Both literature review and an independent survey performed for Cell and Tissue Systems indicates that there is a significant need for a cartilage preservation solution for clinical and research applications that maintains chondrocyte viability, phenotype and cartilage biomaterial properties. The impact of this research will be optimized preservation of both articular cartilage chondrocytes and biomaterial properties making transplants more effective in vivo. Commercialization of this cartilage storage technology will result in increased utilization of banked allogeneic cartilage for reconstruction of articular cartilage defects in younger patients. The solution will also be commercialized for cartilage storage for research and future tissue engineered cartilage products.
* Information listed above is at the time of submission. *