



**CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY**

<b>Name(s)</b> Neda Izadyar	<b>Project Number</b> <b>S0516</b>
<b>Project Title</b> <b>Bioengineering of Bone Fragments in Calcium Alginate Using Canine Adipose Derived Stem Cells Exposed to BMP-7</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The aim of this experiment was to reveal whether adipose derived mesenchymal stem cells can form bone fragments in a three dimensional matrix and in the presence of osteogenic differentiation media. The stimulatory effects of Bone Morphogenic Protein 7 (BMP 7) on osteogenesis and the rate of ossification in adipose differentiated osteocytes were also investigated.</p> <p><b>Methods/Materials</b> The cAD-MSCs acquired a three-dimensional structure using calcium alginate beads. The control group was only exposed to cAD-MSC media. One of the induced groups was exposed to only osteogenic differentiation media while the other was exposed to both osteogenic differentiation media and BMP-7 to test how much of the cell growth can be attributed to BMP-7. Approximately 150,000 cells were mixed into each bead. The cells were cultured for 15 days. The effects of time on cell growth were observed by analyzing half of the bone fragments at day 8 and the other half at day 15. At each day half of the samples were fixed and the bone fragments were stained with Alizarin Red, Mayer's Hematoxylin, and immunofluorescent osteopontin and collagen type I while the other half was sent for RT PCR analysis. These procedures were only completed once due to the lack of time for repetition.</p> <p><b>Results</b> Overall, the data gathered supported the hypothesis. Morphological evaluation revealed that beads cultured in osteogenic media formed densely concentrated structures and that the addition of BMP-7 accelerated formation of those structures. Alizarin red and Hematoxylin staining of the beads revealed positive staining, thus indicating mineralization of the bone fragments. Immunohistochemical staining of the bone fragments with the osteogenic markers osteopontin and collagen type I confirmed the presence of osteogenic cells in the bone fragments. RT-PCR analysis further confirmed the expression of osteogenic specific genes in the in vitro produced bone fragments.</p> <p><b>Conclusions/Discussion</b> In conclusion, canine adipose derived MSCs cultured in calcium alginate matrix and exposed to the osteogenic growth factor BMP-7 experienced an accelerated rate of bone formation. Bone fragments produced in this study were moldable and could potentially be used as bone paste to fill in the damaged bone due to degenerative bone diseases and non-union fractures.</p>	
<b>Summary Statement</b> I exposed canine adipose-derived stem cells to the growth factor Bone Morphogenic Protein-7 and studied its stimulatory effects on ossification and osteogenesis.	
<b>Help Received</b> Utilized laboratory equipment from PrimeGen Biotech under the supervision of Jason Pacchiarotti.	