# AAO Foundation Award Final Report

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| Principal Investigator | Ko, Ching-Chang |
| Co-Investigator | Hu, Wei-Shou |
| Secondary Investigators | Proffit, William R. |
| Award Type | Biomedical Research Award |
| Project Title | Engineering a New Biomaterial for Stem Cell Mediated Bone Regeneration |
| Project Year | 07-01-07 to 06-30-08 |
| Institution | University of North Carolina |
| Summary/Abstract (250 word maximum) | Studies that have been conducted in this AAOF award resulted in the development of a new biomaterial and osteogenesis of MAPC (multipotent adult progenitor cell) on this new material. The new composite named GEMOSIL/HAP is patented through the University of North Carolina; this has led to a new funding recently awarded by North Carolina Biotechnology Center (PI: Ko, CC; 7/1/08-6/30/10). GEMOSIL/HAP consists of bioglass, gelatin and hydroxyapatite with imitated bony ultra-structures. In vitro tests showed that GEMOSIL/HAP is biocompatible and can easily form porous scaffolds with mechanical strengths comparable to that of natural bone. The scaffold with pore size ranging 150 μm to 250 μm provides optimal mechanical strength and cell penetration. The preliminary results of MAPC culture showed that Oct4 and Runx2 expression increased during the first 15 days of cultivation; collagen II, ostrix, Bry, and BMP2 did not show an increasing trend. Nevertheless, in vitro cell proliferation and mineralization (differentiation) on GEMOSIL/HAP were confirmed. In a parallel experiment, we demonstrated that GEMOSIL/HAP could guide cells to form networking mineral structures, which might revolutionize what biomaterials can do to regenerate a functional tissue for load bearing applications. Future development of MAPC-based GEMOSIL tissue engineering has been derived from this result. A NIH grant (PI: Ko, CC), recently reviewed by the NIDCR council meeting on June 23rd and notified in the stage of "Pending Award", will focus on MAPC study and cell-material interaction. |
| Were the original, specific aims of the proposal realized? | Both original Aims have been realized. Pore size 150-250 μm was determined for GEMOSIL/HAP (Aim 1). Osteogenic capacity of MAPC was confirmed and gene expression varied during the cultivation period (Aim 2). |
| Were the results | 1. Ko CC, Luo T-JM, Chi L, Ma A. Hydroxyapatite/gemosil |

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| published? If not, are there plans to publish? If not, why not? | 2. Ko CC, Ferreira J. Developing Future Bioceramics for Temporomandibular Joint Tissue Engineering. In Proceeding of Moyers Symposium. In press. 2008.<br>3. Ying-Lien Wu, Saonli Basu, Ching-Chang Ko Interaction of bone cells and the biomimetic hydroxyapatite/gelatin nanocomposite in vitro. Submitted to Biomaterials 2008. |
| Have the results of this proposal been presented? If so, when and where? If not, are there plans to do so? If not, why not? | 1. Luo T-J Mark and Ko CC. Nanostructured Silica Enforced Hydroxyapatite. ASC (American Society of Chemistry) meeting, 2007.<br>2. Ko CC, Ma A, Kaku M, Liu K-L, Luo T-J M, Tulloch JFC, Hu W-S. The Effect of Hydroxyapatite/GEMOSIL Nanocomposites on Extracellular Matrix Patterning Through the Promotion of Osteoblast Self-organization. 8th World Biomaterials Congress, Amsterdan RAI, the Netherlands, 2008.<br>3. Ma A., Kaku M., Liu K-L, Ko CC. Novel Bioceramic Nano-Composite Prepones Osteoblast Differentiation. AADR meeting, 2008. |