



Department Project Information

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|------------------------|--|----------------------------------|-------------|
| Department Name | MEES | Date Submitted | 12/5/2022 |
| Project Title | Analysis of the effect of metal ions on nerve cells viability and function – BIOMED (UNCC_METAL) | Planned Starting Semester | Spring 2023 |

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

| Discipline | Number | Discipline | Number |
|-------------------|---------------|-------------------|---------------|
| Mechanical | 4 | Electrical | |
| Computer | | Systems | |
| Other () | | | |

Project Overview:

Bioactive ceramic bone grafts have been widely used in orthopedic and maxillofacial surgeries augment and regenerate bone. Moreover, bioactive ceramics provide a controlled release of therapeutic metal ions such as Na, Si, P, Ca, Sr, Mg, Cu, Fe and Zn. These ions can signal cells in bone, blood vessels and nerves. Nerve cells regulate bone metabolism via secretion of neurotransmitters, neuropeptides, neurotrophins, neuronal guidance factors, and participation of nerve-resident cell components (e.g., Schwann cell precursors). While bioceramic dissolution products are known to stimulate bone cells and tissue formation, little is known about their effect on nerve cells. The objective of the project is to analyze the effect of bioactive ceramic dissolution products on nerve cell viability and the production of nerve biological factors. This objective will determine which biological factor is stimulated by which ion(s). The dose response will be analyzed to determine the ion concentration range that stimulates one or more of the above biological factors *in vitro*. The project would create new knowledge and constitute novel science-derived bases for the design of new therapy for bone diseases such as osteoporosis and bone repair in trauma surgery.

Project Requirements:

The students on this team are required to do the following:

- Immerse bio-ceramic granules in physiologic solutions at 37 C for 48 hours
- Characterize the change in the surface composition of the ceramic



- Measure the concentration of the ions released from the ceramic into the solution
- Add various concentrations of the ceramic dissolution products to the tissue culture medium incubated with cultured nerve cells
- Analyze cell viability and the concentration of biological factors produced by nerve cells

Expected Deliverables/Results:

- Data and documentation of the experimental results obtained after conducting the aforementioned tests and analyses.

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the mentor and department. Typically, the work product is displayed at the last Expo then immediately handed over to the mentor. Please confirm your expectation in this section.

List here any specific skills, requirements, specific courses, club affiliation, knowledge needed or suggested (If none please state none):

- BioMed concentration MEGR students