Your Project Title:
An Interdisciplinary Research Project of Mineralized and Soft Tissues during Healthy Ageing

According to the World Health Organization (WHO), the world population is rapidly ageing. Between 2000 and 2050, the proportion of the world’s population over 60 years will double from about 11% to 22%. The total number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period.

Hard (mineralized) tissues (bone, teeth, cartilage, etc.) and soft tissues (tendons, ligaments, fascia, skin, fibrous tissues, synovial membranes, muscles, nerves, blood vessels, etc.) work in concert to perform critical functions such as locomotion, drinking, digestion, etc. For years, the scientific community has been studying these tissues as separate entities. As a result, few exchanges occurred between different specialties and the integrated functions of these tissues at the organ level were somehow neglected.

There is an increasing body of evidence suggests that hard and soft tissues have intense cross talks in order to perform their respective role in maintaining homeostasis both at the organism and the organ levels. For instance, exercises increase muscle strengths and bone cross-sectional area from a global point of view. Biologically, mice deficient in myostatin (a negative regulator of muscle mass) exhibit an increase in both the size and number of type II muscle fibers but also an increase in bone formation leading to higher bone mass. Thus, besides the mechanical stimuli it transmits to bone surface via direct attachment, muscle may regulate bone metabolism via a combination of myokines and progenitor cells release and it is likely that bone influences muscle metabolism as a feed-back control. This example illustrates the need for considering hard and soft tissues as highly integrated and interrelated systems.

Assuming that the National Institute of Arthritis, Musculo-Skeletal and Skin Diseases (NIAMS) has a request for proposal (RFP) that aims at supporting interdisciplinary projects to promote healthy aging and that you plan to write a proposal to that RFP for $1 million over a three-year period. Knowing that it is impossible to examine all possible projects that include integrated research on hard and soft tissues with the limited potentially available budget, you decide to write a limited proposal in response to this funding opportunity that includes the following sections:

A. Abstract: In no more than 300 words, briefly describe the scope of the entire project.
B. Table of Contents: List headings and associated page numbers
C. Introduction and Background: Provide a general overview of the current state-of-the-art understanding of the ailment of your choice and its etiologies. Compare and contrast different schools of thought related to this topic and decide which one you agree with the most or consider the best. Describe or estimate the needed parameters you need to study. Express outcome variables to be used for statistically evaluating the success of the project.
D. Specific Aims: Please list several specific aims to accomplish the proposed research.
E. Research Plan
   a. Materials and Methods: Describe approaches you will use for each aim to study the problem. If experimental studies are needed, explain the materials, methods, instrumentation, etc. Express the relationships among the proposed design method(s) and experimental results.
   b. Expected Outcomes: What are the anticipated outcomes of your proposed research designs.
c. **Potential Problems and Alternative Strategies:** What problems do you anticipate and how would you overcome those problems?

F. **References**
Make sure that you follow the attached guidelines for submission of your response to this exam question. Please note page limitations and proper citation method. Responses that do not follow these guidelines will not be accepted.