Your Project Title

Research Project on Cancer Mechanism, Diagnostic and/or Treatment

According to the National Cancer Institute, the U.S. incidence rate for all cancers combined was 461 new cases diagnosed for every 100,000 people in the population in 2007; the mortality rate was 178 deaths for every 100,000 persons. Since the mid-1970s, there are improvements in survival in people with cancer because of progress in diagnosing certain cancers at earlier stages and improvements in treatment. Combination chemotherapy is now standard in the treatment of many cancers and has contributed to increasing survival and cure rates. Therapies that target the specific molecular changes that cause cells to become cancerous and processes that are required for continuous cancer cell growth and survival are now part of our therapeutic arsenal. To date, the FDA has approved approximately 30 molecularly targeted agents for various cancer, including trastuzumab and three different aromatase inhibitors for breast cancer; imatinib mesylate for chronic myelogenous leukemia and gastrointestinal stromal cell tumors (GIST); sunitinib for advanced kidney cancer and imatinib-resistant GIST; bevacizumab for advanced colorectal, non-small cell lung, and kidney cancers; and bortezomib for multiple myeloma and a type of non-Hodgkin lymphoma. Research advances will continue to explore the use of advanced technologies and new fields of study to find new ways to prevent, diagnose, treat, and screen for cancer. In addition, systems biology approaches will optimize the use of information technology to facilitate cancer research and accelerate our efforts to control cancer.

As part of the 2013 BME qualifying examination, you will write a biomedical engineering research proposal that will address mechanisms, diagnoses and/or treatment of cancer. Because of the nature of the research proposal to incorporate sufficient detail, you are advised to focus on one or at most two aspects from mechanisms, diagnoses and/or treatment of cancer. Write a proposal for $300,000 total direct cost over a three-year period.

Example of ways that you may approach the problem include:

- Project focused on technologies including tools, instrumentation, devices, and associated techniques and/or methods intended for molecular and cellular analyses in-vitro, in-situ, in-silico and/or in-vivo (with some exceptions), and may be targeted for the needs of basic, translational, epidemiology, and/or clinical cancer research.
- Projects focused on the development of technologies that will enable drug developers, biomarker researchers, and epidemiologists to pursue applicable methodologies to improve drug discovery, development, and delivery.
- Project focused on biomedical imaging for whole-body or in vivo imaging methods for cancer diagnostic and/or treatment.
- Projects focused on a biological or clinical hypothesis to understand mechanisms, diagnoses and/or treatment using biotransport, biomechanics, engineering cellular biology and physiology, or signal transduction.
- Projects focused on software/informatics solutions, database development, data mining, statistical tools, and computational/mathematical modeling (including those applicable to drug and/or patient responses).
- Projects focused on biomarker discovery or biomarker validation using microfluidic, and nanomaterials.
- Projects focused on development of specific contrast agents using nanotechnology.
- Projects focused on development of specific drugs or therapies.
Your proposal should include the following sections.

- **Abstract**: In no more than 300 words, briefly describe the scope of the entire project.
- **Table of Contents**: List headings and associated page numbers.
- **Statement of the Problem and Specific Aims**: List several specific aims to accomplish the proposed research.
- **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. Describe or estimate the needed parameters you need to study. Express outcome variables to be used for statistically evaluating the success of the project.
- **Research Plan**
  - **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.
  - **Expected Outcomes**: What are the anticipated outcomes of your proposed research designs.
  - **Potential Problems and Alternative Strategies**: What problems do you anticipate and how would you overcome those problems?
  - **Engineering Aspect of Proposal**: What engineering methods are you developing or proposing to improve?
- **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.