Towards the Development of Personalized Health Care

Present day injury prevention or disease treatment is based on “one intervention fits all” approach. For example, restraint system in a vehicle is frequently designed for crash dummies of a limited number of sizes. Another example is that orthopedic implants are available only for a handful of sizes instead of patient-specific fits. Similarly, present day statistical-based drugs are developed with the entire population in mind instead of tailoring to each individual. In recent years, numerous emerging and sophisticated techniques have been developed in the fields of bioengineering, biomedical engineering, biotechnology, etc. Applying these techniques can potentially preempt injury or disease before it happens. We predict that more and more personalized intervention will become a reality in near future.

To achieve the goal of developing personalized intervention, innovative research approaches are needed. More importantly, research findings should be promptly translated into practice for the benefit of personal and public health. Recognizing the future need and benefit of personalized intervention, a funding agency recently announce a Request for Proposal (RFP) to advance this field based on sound engineering principle. Types of project that will be supported include (but not limited to) the following:

1. Personalized designs of various restrain system (seat belt, helmet, airbag, etc.) to reduce impact induced injury;
2. Personalized designs of medical implants tailored to individual patient;
3. Patient-specific computer assisted surgery;
4. Personalized preventive, diagnostic, and/or therapeutic interventions through genetic composition as well as clinical and family histories.

You are to write a proposal in response to this RFP, which in practice would likely be for $1,000,000 over three years, following conventional NIH guidelines as follows:

1. Executive summary or Abstract: A 1-page short descriptions of the entire project.
2. Background and significance:
   a. Specify the injury or disease you intend to address and the significance of this health issue.
   b. Provide a general overview of the current state-of-the-art in terms of treating or preventing this injury/disease.
   c. Discuss any shortcomings of current practice.
3. Specific Aims: Please consider what new directions can be taken in the future (i.e., with your proposal) and choose two or three specific aims which can be accomplished (potentially) within the budget restraint. Note that there is no need to provide a budget. However, you must not propose a project that would require an extraordinary amount of funding to accomplish the proposed goals.
4. Research Plan:
   a. Describe how you would improve on the design of existing practices. It is important that you must propose plans to conduct relevant engineering analyses.
   b. Discuss the statistics of validating any new method you are proposing. If you are redesigning any component of the system, describe how you would do this with modern design equipment. Your description should also include the experimental approaches of how you would test your proposed solution, including the materials, methods, time-line, instrumentation needed.
   c. Describe methods for translating your findings to practice.
   d. Consortium, Contractual Agreements (if any): With what types of specialists would you seek collaboration for your project?
   e. Expected Outcomes: What are the anticipated outcomes of your proposed experiments and evaluations?
   f. Potential Problems and Alternative Strategies: What problems do you anticipate that you are likely to encounter, and how would you overcome those problems?