



## CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:  
RP160232

Project Title:  
Understanding Biological and Physical Factors Affecting Response to  
Proton Therapy to Improve its Clinical Effectiveness

Award Mechanism:  
Individual Investigator

Principal Investigator:  
Mirkovic, Dragan

Entity:  
The University of Texas M.D. Anderson Cancer Center

### Lay Summary:

Radiation therapy, often in combination with other modalities, is used in the treatment of nearly two-thirds of the 1.7 million cancers diagnosed annually in the US. Its clinical effectiveness has steadily been improving with the latest advance being proton therapy. In principle, because of their unique physical properties, protons have the potential to be much more effective than the currently prevalent modality of photons. The most advanced, and potentially the most effective form of proton therapy, is intensity-modulated proton therapy (IMPT). IMPT is delivered with thin scanning beams ("beamlets") of protons. Despite proton therapy's high promise, clinical evidence of its superiority has been limited. The main reasons are uncertainties in proton doses delivered and the still maturing technology. Protons, IMPT in particular, are sensitive to perturbations caused by changes in patient position and anatomy during the course of therapy. Also, methods to plan proton treatments are still relatively primitive. Most importantly, the biological effectiveness of protons, compared to photons, is simplistically assumed to be a constant though it is known to vary. The goals of the proposed research are (1) to understand the potential consequences of uncertainties in proton therapy; (2) to understand how tissues and tumors respond to proton therapy by analyzing data of patients treated with protons; (3) to develop predictive models of response; and (4) to incorporate the knowledge thus gained to substantially enhance the robustness and clinical effectiveness of IMPT. The potential of proton therapy has led to rapid growth in the number of proton centers worldwide. In Texas, three such centers are in operation or nearing completion, the most per capita in the nation. Considering the high cost of such facilities, the research proposed for realizing the true potential of this promising modality is of great significance for cancer patients in Texas and elsewhere.