Pelvic sarcoma surgery is one of the most challenging procedures performed by an orthopedic oncologist. If the leg, but not the hip joint, can be salvaged when removing the malignant pelvic tumor, the surgeon and patient must decide whether or not the resected anatomy should be reconstructed. Current options include no reconstruction or reconstruction with an alloprosthesis (i.e., bone allograft to replace the resected pelvic bone plus a total hip replacement to replace the resected hip joint), while an emerging option is reconstruction with a custom prosthesis (like an alloprosthesis except with metal replacing the bone allograft). While a custom prosthesis should theoretically yield the best post-surgery walking function and shortest recovery time, prosthesis failure rates are high, discouraging orthopedic oncologists from pursuing this option.

The **goal** of the proposed project is to predict how choice of surgical treatment (no reconstruction, alloprosthesis reconstruction, or custom prosthesis reconstruction) and associated surgical decisions will affect post-surgery walking function for individual patients being treated for pelvic sarcoma. Predictions will be generated using patient-specific computational walking models. Since custom prostheses are not currently available clinically, the research team will design its own durable custom prostheses using patient-specific 3D imaging, movement, and bone loading data and will manufacture the prostheses using 3D printing methods. Regardless of surgical method, each patient's post-surgery walking function will be measured using optical motion capture and bi-plane dynamic x-ray technology to evaluate the walking predictions and quantify bone-bone or prosthesis-bone micro-motion that can hinder bone healing. Project tasks will be used to train graduate and undergraduate students in modeling and cancer research. ***If successful, the proposed project could significantly improve the standard of care for pelvic sarcoma patients.***