

Priorities Conference in Biomechanics Personal Statement

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Human locomotion biomechanics spans domains and subdisciplines in the study of a complex neuromuscular task. In many cases, applied research builds upon basic research and results have profound impact. In other areas, research efforts are largely splintered and collective progress is impeded.

Understanding human movement with a prosthesis in a person with limb loss is a particularly challenging and interesting goal for the biomechanist. From a whole-body biomechanics perspective, clinical questions are plentiful, but often unfocused. Once the questions are refined, their answers may have a positive effect on the treatment of a usually limited subset of individuals with a certain clinical presentation. Consequently, much of the whole-body biomechanics research in prosthetics makes incremental contribution.

Broader and more fundamental research questions remain unanswered. For example, it is a relatively trivial proposition to compare gait outcomes in a set of individuals using different sorts of prosthetic components. One might determine that some individuals walk better using some component while others prefer another. Such results are difficult to generalize given the context of complex neural, muscular, skeletal, and mechanical systems. A basic problem exists with the very nature of prosthetic component design. The goals of the individual with limb loss and the biomechanical optimization criteria he or she wishes to maximize are not determined or customized; they are only assumed. Design must rely too heavily on iteration and trial-and-error.

Addressing these broader questions is perhaps beyond the scope of any individual researcher or laboratory. However, the task is not impossible. Trans-domain collaboration is essential for transformational research.

Recommendation: Funding agencies should facilitate hypothesis development research in limb prosthetics that combines trans-domain resources and expertise from areas including:

- Human locomotion and gait analysis
- Prosthetic component design and material testing
- Prosthesis interface biomechanics
- Clinical care and rehabilitation of individuals with limb loss
- Musculoskeletal modeling and simulation
- Neuromotor optimization
- Human joint and limb anatomy and physiology
- Activities of daily living, activity monitoring
- Outcome measures