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My perspective on trans-domain and translational research in the field of biomechanics is very much influenced by my career path, which to many, would be considered unconventional. My undergraduate path included brief stops in music (clarinet), mathematics, computer programming, and civil engineering, before finding a home in mechanical engineering. I was first employed at General Electric's Aerospace Control Systems Department. Having been a competitive swimmer, it was natural for me to apply principles of fluid dynamics that I used at General Electric, to swimmers I coached at a local university. Graduate degrees in Biomechanics soon followed, where I applied computer programming skills to implement two- and three-dimensional inverse dynamic analyses. It was in preparation for the latter that my advisor suggested I use a new technique, borrowed from robotics, that would eventually become known as six degree-of-freedom (6DOF) biomechanics.

Decades later, I can see the impact of that suggestion. My desire to provide the best possible gait analyses for pediatric patients led me to leave conventional gait models in favor of 6DOF techniques. I could make a strong theoretical argument that allowing for unconstrained movements by adjacent body segments was more likely to accurately characterize joint pathology. The bulk of my research highlights the strengths and weaknesses of these techniques in meeting clinical needs, or in answering fundamental questions in human movement.

Today, we see the emergence of very valuable moment or muscle actuated forward dynamic simulations of gait. Nearly all of these simulations have been based upon global optimization, and the majority of the data sets that seed these simulations have derived from the conventional gait model. Induced acceleration analyses use a similar foundation. Inherent in these analyses are assumptions about expected degrees-of-freedom at normal anatomical joints. I believe many of the conclusions drawn by our technical partners are overly definitive, and suggest a lack of day-to-day clinical experience. I believe many of our clinical partners do not have the technical background to challenge these conclusions. A need exists to build a "trans-domain bridge" between technical and clinical partners, from which enahnced translational research can emerge.

Recommendations include:

1. Foster collaborations between university engineering departments engaged in clinical research, and clinical laboratories with a depth of technical awareness. This is not intended to diminish the contribution of more clinically based laboratories; it is intended to provide more direct dialogue to enhance conclusions drawn from simulations.
2. Foster development of educational materials for clinical partners to enhance their understanding of simulations, particularly their analytical foundation, their strengths, and their weaknesses.
3. Foster development of educational materials for technical partners to enhance their understanding of clinical treatments, particularly their medical foundation, their strengths (desired outcomes achieved), and their weaknesses.
4. Foster development of techniques to characterize true pathological motion, as opposed to global optimizations based upon normal joints.
5. Expand these rationales beyond gait analysis to general human movement.