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The NIH road map for research stresses interdisciplinary teams and translational research. Biomechanics is ideally poised to bridge multiple disciplines, and thus biomechanists are ideal team members for translational research programs. Clearly there are multiple important areas of research focus for biomechanics at the cellular and structure level. However, I will focus my statement on important issues in biomechanics relevant at the activity and participation level. Most specifically, I believe that biomechanists need to be integrally involved in an effort to move clinical assessment into a model in which clinicians are provided with a theoretical framework and associated measurement tools to personalize rehabilitation. For example, to address mobility restrictions after neurological disorders (such as stroke) there is a need to improve the interpretability of clinical assessment scores by defining what it means (neuromechanically) when a person cannot perform, or performs poorly, specific mobility tasks. What is needed is to: 1) define an underlying motor control model as a construct that explains current impairments and future recovery; 2) identify tasks that represent important mobility skills; 3) identify critical neuromotor factors that contribute to performance of that task; and 4) make it possible for those mobility tasks to be used as observed "items" by which a therapist can assess a client's performance in the clinic. That is, a therapist can administer the "item" (i.e., observe performance of the mobility task) and understand what it means when a client can/cannot successfully perform the behavior. Items could be generated via laboratory and simulation-based testing of this motor control construct and it's mapping to mobility performance and capability. Thus, such an approach will eventually provide a clinical assessment toolbox enabling clinicians to develop person-specific targeted therapies leading to better outcomes and more cost-effective treatment. This will establish an approach to rehabilitation to restore mobility that differs significantly from current practice where the linkage between neural output impairment, biomechanical function, and mobility performance is, at best, ill-defined and implicit. Below are specific recommendations:

1. **Modeling and simulation research is needed to understand the complexities of muscle coordination of movement in clinical populations.** Computer simulations are powerful because they are based on cause/effect (neural output excites muscles to cause motor action) and integrate musculoskeletal anatomy, physiology, and behavioral observations. However, there also needs to be innovative methodologies for validation and more direct relevance for clinical measurement. Simulations are an ideal tool for explaining deviations in movement patterns discernable by clinical observation.
2. **Innovative experiments are needed to verify basic science findings in neural control of movement translate to human control of movement.** Most of our understanding of motor control comes from study of cats, rats and invertebrates. Biomechanists need to lead research that establishes the applicability of these basic science models to human control of movement in our clinical populations. We need robust models of neurological dysfunction that can serve as a basis for clinical measurement.
3. **Better neurobiomechanical frameworks for explaining impaired movements in clinical populations are needed such that impaired performance of an activity can be very specifically related to underlying impairments.** Clinicians need to be able to interpret very specifically the needs of individual patients so that rehabilitation can directly target those needs. Clinical measurement will not improve simply by adding different or better items to clinical instruments. Instead, measurement needs to be informed very specifically by theoretical models of impairment.
4. **Contemporary psychometric measurement models (e.g., Item Response Theory) are needed to develop clinical measures that are consistent with neurobiomechanical models of impaired movement, such as walking and recovery of walking following stroke.** Once appropriate theoretical frameworks exist, contemporary measurement techniques are needed to develop the best clinical measurement.

At present, clinicians have a measurement framework that is theoretically and practically insufficient to inspire effective evidence-based and personalized rehabilitation. Rehabilitation needs to move much closer to a model where knowledge of the linkage between impairment, limitations and participant restriction is used to improve quality of life. That is: 1) the health of a person's mobility motor control system would be assayed; 2) specific deficits would be identified that would also indicate any potential risk in performing mobility tasks; 3) specific treatments would be used to target the deficits and reduce the associated risks; and 4) quantitative measures would provide assessment of the pre- and post-treatment states. Evidence based research will continue to lag until there is development of a suitable theoretical framework that encompasses motor control impairments, their related biomechanical consequences, and the mechanical demands of mobility tasks. Biomechanists will be integral to providing this understanding.