Stanford

Jessica Rose

Professor of Orthopaedic Surgery

Bio

ACADEMIC APPOINTMENTS

- Professor - University Medical Line, Orthopaedic Surgery
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Research Committee, International Alliance of Academies of Childhood Disability (IAACD), (2020-2023)
- Faculty Senate, Stanford University School of Medicine, (2013-2022)
- Director, Motion & Gait Analysis Lab, Lucile Packard Children’s Hospital, Stanford Children's Health, (1989- present)
- Chair, Research Committee, American Academy for Cerebral Palsy and Developmental Medicine, (2013-2015)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, NIH AACPDM Steering Committee on Common Data Elements for Cerebral Palsy (2018 - present)
- Board of Directors, Society for Brain Mapping and Therapeutics (2013 - present)
- Spectrum Child Health Research Institute Committee Member, Stanford University School of Medicine (2013 - present)
- Research Committee Member, American Academy for Cerebral Palsy and Developmental Medicine (2009 - 2015)
- Taskforce on Childhood Motor Disorders, NIH (2001 - 2012)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Dr. Rose directs the Motion & Gait Analysis Lab at Lucile Packard Children's Hospital, a multidisciplinary diagnostic service for patients with gait and upper limb movement disorders. Dr. Rose's research investigates early brain and motor development in preterm children and the neuromuscular mechanisms underlying motor deficits in children with cerebral palsy (CP).

Prior research investigated energy cost of walking, muscle pathology, neuromscular activation and postural balance in CP. Recent research investigates neonatal micro-structural brain development on diffusion tensor MRI in relation to motor function in preterm children.

Initial research examined energetics of walking in CP and muscle pathophysiology in spastic CP (Rose et al, J Orthop Res, 1994). The histologic and morphometric study of spastic muscle in CP revealed abnormal predominance of type-1 fibers and fiber size variability, suggesting reduced motor-unit firing rates associated with impaired descending motor signals. Neuromuscular activation and motor-unit firing characteristics were investigated with EMG decomposition techniques in lower limb muscles in CP (Rose and McGill, Dev Med Child Neurol, 2005). We found maximal voluntary neuromuscular activation (maximal voluntary EMG/ M-wave amplitude) was substantially reduced, while motor-unit recruitment was found normal at low-moderate levels of contraction. Extrapolation to maximal levels of neuromuscular activation suggested maximal motor-unit firing rates were reduced to approximately 50% of control values.

Four interrelated motor deficits of spastic CP: weakness, short muscle-tendon unit, spasticity, and impaired selective motor control were identified through these studies. EMG studies of selective motor control revealed obligatory muscle co-activation of gastrocnemius during quadriceps activation contributes to gait deficits in spastic CP (Rose et al, J Ped Orthop, 1999, Policy et al, J Ped Orthop, 2001). Postural balance research using force plate center-of pressure indicated 30% of children with spastic CP had balance impairment (Wolff et al, J Orthop Res, 1998, Rose et al, Dev Med Child Neurol, 2002).

Recent research examined neonatal micro-structural brain development on diffusion tensor MRI and motor function in very-low-birth-weight preterm children (Rose et al, Ped Res, 2005, Rose et al. Dev Med Child Neurol 2007; 2009). Related research investigated cerebellar structure and postural balance in adults.

Early regional brain development and perinatal risk factors at near-term age were studied in relation to later motor deficits. This research identified neonatal prognostic indicators of later motor function to guide early, more effective intervention.

Dr. Rose served on the Neurophysiology section of the NIH Taskforce on Childhood Motor Disorders, chaired the Research Committee of the American Academy for Cerebral Palsy and Developmental Medicine (AACPDM), served on the Board of Directors of the Society for Brain Mapping and Therapeutics (SBMT), led the Research Network on Artificial Walking Technologies for multichannel NMES-assisted Gait for Children with CP and is on the International Alliance of Academies of Childhood Disability (IAACD). She is co-editor of the book, Human Walking 3rd Edition, (Rose J and Gamble JG, Editors, Lippincott, WilIiams and Wilkins, 2006), a multidisciplinary perspective on human walking and gait analysis. She taught Anatomy of Movement (Ortho 222), a multidisciplinary course on musculoskeletal anatomy from perspectives of bioengineering, anthropology, and art history. She collaborated with professor Kazerooni of UC Berkely and US Bionics on development of a pediatric exoskeleton, which won the Robotics for Good international competition 2016.

Teaching

STANFORD ADVISEES

Postdoctoral Research Mentor

Sung Eun Kim

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Bioengineering (Phd Program)

Publications

PUBLICATIONS

- **Validation of Inertial Measurement Units for Analyzing Golf Swing Rotational Biomechanics.** *Sensors (Basel, Switzerland)*
  Kim, S. E., Burket Koltsov, J. C., Richards, A. W., Zhou, J., Schadl, K., Ladd, A. L., Rose, J.
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- **The swing performance Index: Developing a single-score index of golf swing rotational biomechanics quantified with 3D kinematics.** *Frontiers in sports and active living*
  Zhou, J. Y., Richards, A., Schadl, K., Ladd, A., Rose, J.
  2022; 4: 986281

- **Neuromuscular electrical stimulation to augment lower limb exercise and mobility in individuals with spastic cerebral palsy: A scoping review.** *Frontiers in physiology*
  Greve, K. R., Joseph, C. F., Berry, B. E., Schadl, K., Rose, J.
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- **Neonatal Brain Microstructure and Machine-Learning-Based Prediction of Early Language Development in Children Born VeryPreterm.** *Pediatric neurology*
  Vassar, R., Schadl, K., Cahill-Rowley, K., Yeom, K., Stevenson, D., Rose, J.
  2020

- **Neonatal white matter tract microstructure and 2-year language outcomes after preterm birth.** *NeuroImage. Clinical*
  Dubner, S. E., Rose, J. n., Bruckert, L. n., Feldman, H. M., Travis, K. E.
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- **Editorial: Neurologic Correlates of Motor Function in Cerebral Palsy: Opportunities for Targeted Treatment.** *Frontiers in human neuroscience*
  Rose, J., Papadelis, C., Gaebler-Spira, D.
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- **Prediction of Gait Impairment in Toddlers Born Preterm From Near-Term Brain Microstructure Assessed With DTI, Using Exhaustive Feature Selection and Cross-Validation** *FRONTIERS IN HUMAN NEUROSCIENCE*
  Cahill-Rowley, K., Schadl, K., Vassar, R., Yeom, K. W., Stevenson, D. K., Rose, J.
  2019; 13

- **Prediction of Gait Impairment in Toddlers Born Preterm From Near-Term Brain Microstructure Assessed With DTI, Using Exhaustive Feature Selection and Cross-Validation.** *Frontiers in human neuroscience*
  Cahill-Rowley, K., Schadl, K., Vassar, R., Yeom, K. W., Stevenson, D. K., Rose, J.
  2019; 13: 305

- **A Scoping Review of Neuromuscular Electrical Stimulation to Improve Gait in Cerebral Palsy: The Arc of Progress and Future Strategies** *FRONTIERS IN NEUROLOGY*
  Mooney, J. A., Rose, J.
  2019; 10

- **The Pediatric Temporal-spatial Deviation Index: quantifying gait impairment for children with cerebral palsy.** *Developmental medicine and child neurology*
  Zhou, J. Y., Zhang, K., Cahill-Rowley, K., Lowe, E., Rose, J.
  2019

- **Prediction of cognitive and motor development in preterm children using exhaustive feature selection and cross-validation of near-term white matter microstructure.** *NeuroImage. Clinical*
  Schadl, K., Vassar, R., Cahill-Rowley, K., Yeom, K. W., Stevenson, D. K., Rose, J.
  2018; 17: 667-679

- **Neuromuscular correlates of motor function in cerebral palsy: towards targeted treatment.** *Developmental medicine and child neurology*
  Rose, J.
  2018

- **A common data language for clinical research studies: the National Institute of Neurological Disorders and Stroke and American Academy for Cerebral Palsy and Developmental Medicine Cerebral Palsy Common Data Elements Version 1.0 recommendations** *DEVELOPMENTAL MEDICINE AND CHILD NEUROLOGY*
  Schiariti, V., Fowler, E., Brandenburg, J. E., Levey, E., Mcintyre, S., Sukal-Moulton, T., Ramey, S. L., Rose, J., Sienko, S., Stashinko, E., Vogtle, L., Feldman, R. S., Koenig, et al
  2018; 60 (10): 976-+

- **A common data language for clinical research studies: the National Institute of Neurological Disorders and Stroke and American Academy for Cerebral Palsy and Developmental Medicine Cerebral Palsy Common Data Elements Version 1.0 recommendations.** *Developmental medicine and child neurology*

Schiariti, V., Fowler, E., Brandenburg, J. E., Levey, E., Mcintyre, S., Sukal-Moulton, T., Ramey, S. L., Rose, J., Sienko, S., Stashinko, E., Vogtle, L., Feldman, R. S., Koenig, et al
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- **Golf Swing Rotational Velocity: The Essential Follow-Through.** *Annals of rehabilitation medicine*
  Steele, K. M., Roh, E. Y., Mahtani, G., Meister, D. W., Ladd, A. L., Rose, J.
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- **Temporal-spatial reach parameters derived from inertial sensors correlate to neurodevelopment in toddlers born preterm** *JOURNAL OF BIOMECHANICS*
  Cahill-Rowley, K., Rose, J.
  2018; 72: 17–22

- **Prediction of cognitive and motor development in preterm children using exhaustive feature selection and cross-validation of near-term white matter microstructure** *NEUROIMAGE-CLINICAL*
  Schadl, K., Vassar, R., Cahill-Rowley, K., Yeom, K. W., Stevenson, D. K., Rose, J.
  2018; 17: 667–79

- **Artificial Walking Technologies to Improve Gait in Cerebral Palsy: Multichannel Neuromuscular Stimulation** *ARTIFICIAL ORGANS*
  Rose, J., Cahill-Rowley, K., Butler, E. E.
  2017; 41 (11): E233–E239

- **Corticoreticular tract lesion in children with developmental delay presenting with gait dysfunction and trunk instability** *NEURAL REGENERATION RESEARCH*
  Kwon, Y., Rose, J., Kim, A., Son, S.
  2017; 12 (9): 1465–71

- **Neurologic Correlates of Gait Abnormalities in Cerebral Palsy: Implications for Treatment** *FRONTIERS IN HUMAN NEUROSCIENCE*
  Zhou, J., Butler, E. E., Rose, J.
  2017; 11

- **Temporal-spatial reach parameters derived from inertial sensors: Comparison to 3D marker-based motion capture.** *Journal of biomechanics*
  Cahill-Rowley, K., Rose, J.
  2017; 52: 11-16

- **The Change of Intra-cerebral CST Location during Childhood and Adolescence; Diffusion Tensor Tractography Study** *FRONTIERS IN HUMAN NEUROSCIENCE*
  Kwon, Y. M., Kwon, H. G., Rose, J., Son, S. M.
  2016; 10

- **Toddle temporal-spatial deviation index: Assessment of pediatric gait.** *Gait & posture*
  Cahill-Rowley, K., Rose, J.
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- **Temporal-spatial gait parameters and neurodevelopment in very-low-birth-weight preterm toddlers at 18-22 months.** *Gait & posture*
  Cahill-Rowley, K., Rose, J.
  2016; 45: 83-89

- **Neonatal Biomarkers of Inflammation: Correlates of Early Neurodevelopment and Gait in Very-Low-Birth-Weight Preterm Children** *AMERICAN JOURNAL OF PERINATOLOGY*
  Rose, J., Vassar, R., Cahill-Rowley, K., Hintz, S. R., Stevenson, D. K.
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- **Neonatal Biomarkers of Inflammation: Correlates of Early Neurodevelopment and Gait in Very-Low-Birth-Weight Preterm Children.** *American journal of perinatology*
  Rose, J., Vassar, R., Cahill-Rowley, K., Hintz, S. R., Stevenson, D. K.
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- **Biomechanical and Clinical Correlates of Stance-Phase Knee Flexion in Persons With Spastic Cerebral Palsy.** *PM & R : the journal of injury, function, and rehabilitation*
  Rha, D. W., Cahill-Rowley, K., Young, J., Torburn, L., Stephenson, K., Rose, J.
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- **Clinical motion analyses over eight consecutive years in a child with crouch gait: a case report.** *Journal of medical case reports*
  Butler, E. E., Steele, K. M., Torburn, L., Gamble, J. G., Rose, J.
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- **Biomechanical and Clinical Correlates of Stance-Phase Knee Flexion in Persons With Spastic Cerebral Palsy** *PM&R*
  Rha, D., Cahill-Rowley, K., Young, J., Torburn, L., Stephenson, K., Rose, J.
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  Rose, J., Cahill-Rowley, K., Vassar, R., Yeom, K. W., Stecher, X., Stevenson, D. K., Hintz, S. R., Barnea-Goraly, N.
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- **Biomechanical and clinical correlates of swing-phase knee flexion in individuals with spastic cerebral palsy who walk with flexed-knee gait.** *Archives of physical medicine and rehabilitation*
  Rha, D., Cahill-Rowley, K., Young, J., Torburn, L., Stephenson, K., Rose, J.
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- **Movement disorders due to bilirubin toxicity.** *Seminars in fetal & neonatal medicine*
  Rose, J., Vassar, R.
  2015; 20 (1): 20-25

- **Identification of Neonatal White Matter on DTI: Influence of More Inclusive Thresholds for Atlas Segmentation** *PLOS ONE*
  Vassar, R. L., Barnea-Goraly, N., Rose, J.
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- **The 2014 ABJS Nicolas Andry Award: The Puzzle of the Thumb: Mobility, Stability, and Demands in Opposition** *CLINICAL ORTHOPAEDICS AND RELATED RESEARCH*
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- **The 2014 ABJS Nicolas Andry Award: The puzzle of the thumb: mobility, stability, and demands in opposition.** *Clinical orthopaedics and related research*
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- **Brain microstructural development at near-term age in very-low-birth-weight preterm infants: An atlas-based diffusion imaging study.** *NeuroImage*
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- **Neonatal physiological correlates of near-term brain development on MRI and DTI in very-low-birth-weight preterm infants.** *NeuroImage. Clinical*
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  Vassar, R. L., Rose, J.
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  Vassar, R. L., Barnea-Goraly, N., Rose, J.
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- **The Pediatric Upper Limb Motion Index and a temporal-spatial logistic regression: Quantitative analysis of upper limb movement disorders during the Reach & Grasp Cycle** *JOURNAL OF BIOMECHANICS*
  Butler, E. E., Rose, J.
  2012; 45 (6): 945-951

- **Rotational Biomechanics of the Elite Golf Swing: Benchmarks for Amateurs** *JOURNAL OF APPLIED BIOMECHANICS*
  Meister, D. W., Ladd, A. L., Butler, E. E., Zhao, B., Rogers, A. P., Ray, C. J., Rose, J.
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- **Physiologic Correlates of T'ai Chi Chuan** *JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE*
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- **Definition and Classification of Hyperkinetic Movements in Childhood** *MOVEMENT DISORDERS*
  Sanger, T. D., Chen, D., Fehlings, D. L., Hallett, M., Lang, A. E., Mink, J. W., Singer, H. S., Alter, K., Ben-Pazi, H., Butler, E. E., Chen, R., Collins, A., Dayanidhi, et al
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- **Three-dimensional kinematics of the upper limb during a Reach and Grasp Cycle for children** *GAIT & POSTURE*
  Butler, E. E., Ladd, A. L., Louie, S. A., Lamont, L. E., Wong, W., Rose, J.
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- **Mechanisms of Postural Control in Alcoholic Men and Women: Biomechanical Analysis of Musculoskeletal Coordination During Quiet Standing** *ALCOHOLISM-CLINICAL AND EXPERIMENTAL RESEARCH*
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- **Selective motor control in spastic cerebral palsy** *DEVELOPMENTAL MEDICINE AND CHILD NEUROLOGY*
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  Rose, J., Butler, E. E., Lamont, L. E., Barnes, P. D., Atlas, S. W., Stevenson, D. K.
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- **Postural sway reduction in aging men and women: Relation to brain structure, cognitive status, and stabilizing factors** *NEUROBIOLOGY OF AGING*
  Sullivan, E. V., Rose, J., Rohlfing, T., Pfefferbaum, A.
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- **Neonatal microstructural development of the internal capsule on diffusion tensor imaging correlates with severity of gait and motor deficits** *DEVELOPMENTAL MEDICINE AND CHILD NEUROLOGY*
  Rose, J., Mirmiran, M., Butler, E. E., Lin, C. Y., Barnes, P. D., Kermoian, R., Stevenson, D. K.
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- **Classification and definition of disorders causing hypertonia in childhood** *PEDIATRICS*
  Sanger, T. D., Delgado, M. R., Gaebler-Spira, D., Hallett, M., Mink, J. W.
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  Policy, J. F., Torburn, L., Rinsky, L. A., Rose, J.
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