

CDMI Research Roadmap 2022

	MSD Prevention	Healthcare Data	Biomedical Sciences	Clinical Medicine
Advanced Science	<ul style="list-style-type: none"> • Mechanisms of Back Pain, Disc Degeneration • Exposures for Secondary Back Injury • Injury Causal Pathway Interactions (pain-function, biology-mechanics, psychosocial influences-tissue load, genetics) • Biomechanical Shoulder Modeling (as a function of job demands) • Musculoskeletal Fatigue (causes, recovery from) • Issues with the Aging Population (changes in tissue tolerances, tissue recovery) 	<ul style="list-style-type: none"> • Tools for Analyzing Electronic Health Records (NLP, AI, ML, etc.) • Evaluation of ROI and Economic Value (potential for translation into application) • Predictive Models for Outcomes of Clinical Therapies • Patient Risk Stratification • Quantifying Complications of Standard Spinal Procedures (infection, non-union) 	<ul style="list-style-type: none"> • Bone Fracture Prevention • Regenerative Medicine, Ortho Biologics • Musculoskeletal Tissue Engineering • Biomaterials <ul style="list-style-type: none"> • Bone substitute materials providing structural integrity • Biocompatibility and resorption of biomaterials • Surface modification of materials for better antibacterial or osseointegration properties • Bioresorbable cements suitable for fracture healing, drug delivery, etc. • High -strength, -stiffness, -elongation metallic alloys (e.g., MoRe alloy) • Relationship between material properties and bone growth, inflammation, infection • Orthopedic Biomechanics 	<ul style="list-style-type: none"> • Strategies to Improve Success with Osteoporotic Patients (including treatment) • Early Onset Scoliosis / Adolescent Idiopathic Scoliosis / Spinal Deformity • Technologically Advanced Clinical Screening and Intervention Methods • Integrating Data Representing the Whole Patient (bio-psycho-social model and disease)
Applications	<ul style="list-style-type: none"> • Ergonomics Interventions <ul style="list-style-type: none"> ◦ Improved methods to: <ul style="list-style-type: none"> ◦ Estimate return-on-investment ◦ Determine trade-offs between potential ergo improvements ◦ Assess added push-pull task factors • Employee-Centered Training • Patient Handling 	<ul style="list-style-type: none"> • Clinical Data <ul style="list-style-type: none"> • Clarifying reimbursement pathways • Patient preference (risk, treatment and outcome) • Automated image segmentation • Advanced MRI sequences for identifying tissues of interest • Novel biomarker identification (saliva, blood, imaging, biomechanics, biobehavioral, etc.) • COVID/telehealth 	<ul style="list-style-type: none"> • 3D Printing of Tissues to Reduce Need for Metal/ Screws 	<ul style="list-style-type: none"> • Clinical Outcomes <ul style="list-style-type: none"> • Quantifying health disparities on access to care and clinical outcomes • Functional testing (in clinic biomechanics) • Metrics and diagnostic tools for determining patient improvement / safe RTW practices • Predictive analytics / artificial intelligence to determine the 'right' procedure and success potential for a specific patient / pathology
Innovative Technologies	<ul style="list-style-type: none"> • Validation Studies (risk assessment accuracy, data from wearables) • Prediction of Workplace Injury (using big data, IoT technology, imagery surveillance AI, etc.) • Biomechanical Evaluations (e.g., exoskeletons, exosuits) • Composite Injury Risk Indices (whole body, body-part specific) 	<ul style="list-style-type: none"> • Infection (technologies to minimize infections, implant surface treatments) • Software Tools to Integrate Novel Biomarkers with Electronic Health Record Data • Incorporating New Information Streams into Clinical Decision-Making (e.g., expert augmented machine learning) • Access to Large EHR Datasets (UC system-wide clinical data, UCSF Information Commons) 	<ul style="list-style-type: none"> • Image-Guided / Robotic Surgery • Implantable Sensors / Stimulators • Bone Healing and Fusion Sensing Devices • Tools / Techniques for FDA-Required Unique Identifiers 	<ul style="list-style-type: none"> • Imaging Technology in Orthopedics (e.g., device loosening, detection of disc degeneration, osteoporosis assessment, fracture risk evaluation) • Digital Health / Methods to Quantify Pain and Future Digital / Sensor-Based Outcome Measures (wearables) • SMART Devices