

## CDMI Research Roadmap 2022

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