

EXPERIENCE

Research Engineer B | Dec 2022 - Present

Research Engineer A | Oct 2020 - Dec 2022

The Gullbrand & Mauck Labs | University of Pennsylvania | Philadelphia, PA

The Gullbrand Lab seeks to understand and treat low back pain. My work translated a total tissue-engineered replacement disc from the bench to preclinical large animal models. I led the development and execution of cell screening, biomaterial, and drug delivery experiments to optimize tissue regeneration. My team characterized disc degeneration, its crosstalk with adjacent tissues, and tested the effects of exercise, cell, and biomaterial therapies on spine health.

- o Increased bone formation on our scaffolds by 38.02% in vivo via material and chemical modifications
- o Managed administration for a team of 14, including safety reviews and \$150,000 of annual budget
- o Maintained BSL2 culture facility and 10 pieces of equipment, including the tissue processing core
- o Personally mentored and trained 8 lab members with both their research projects and writing
- o Edited and copyedited over 40 presentations and 8 manuscripts presenting Gullbrand Lab data
- o Created a lab color-blind friendly color palette and branding guide for improved visual unity

Biomaterials Researcher | Jan 2019 - May 2020

GELH (Grants for Experiential Learning in Health) Scholar

The Chow Lab | Lehigh University | Bethlehem, PA

Developed scaffolds for the regeneration of the osteochondral interface using 3D-printed peptide-polymer conjugates.

- o Synthesized, fabricated, and characterized peptide-modified scaffolds for in vitro experimentation
- o Standardized synthesis and click chemistry protocols for lab use and publication

Climate Science Design Engineer | Oct 2020 - Dec 2022

Partnership between OSIsoft & Lehigh University's Office of Sustainability | Bethlehem, PA

Built a database to manage Lehigh University's real-time utility data for all 196 buildings on campus in order to increase efficiency for campus energy staff and educate the student body on the campus's environmental footprint.

- o Designed and created a visual interface to manage energy efficiency and tell Lehigh's energy story
- o Collaborated with a leadership team of 5 to supervise a team of 40 student volunteers
- o Planned 25 events annually engaging 800+ students in climate science to promote sustainable behavior changes on topics including energy use, fast fashion, plastic waste, and food systems.

AREAS OF EXPERTISE AND SELECTED SKILLS

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|---------------------------------|-----------------------------|---------------|
| o Science writing | o Polymeric biomaterials | o Adobe suite |
| o Stem cell culture & screening | o Drug delivery | o Fusion 360 |
| o Animal models | o Histology Paraffin & Cryo | o Solidworks |

EDUCATION

PhD Student, Bioengineering

University of Pennsylvania | Philadelphia, PA | 2025 - Present

BS, IDEAS (Integrated Degree in Engineering, Arts & Sciences)

Lehigh University | Bethlehem, PA | 2020

Concentrations: Biomechanics & Biomaterials Engineering and Art & Design

AWARDS

- **Katz Family Award in Orthopaedic Surgery | 2024**
Recognizing work focusing on empathy, diversity, and cultural awareness in Orthopaedics at Penn
- **Undergraduate Student Sustainability Award | 2019**
Recognizing outstanding work pursuing and implementing sustainably focused projects and education

SERVICE

McKay RAD (Representation and Anti-Discrimination) Committee

McKay Orthopaedics Department | University of Pennsylvania | Philadelphia, PA | 2025 - Present

- Developed curriculum for monthly learning lunches covering the intersections of science and society

McKay DEI (Diversity, Equity, and Inclusion) Committee

McKay Orthopaedics Department | University of Pennsylvania | Philadelphia, PA | 2020 - 2023

- Designed, wrote, and managed monthly internal department DEI newsletter
- Instituted internal community-building events for a department of 160 people
- Assisted planning 3 conference grants for funding undergraduate conference attendance

PROFESSIONAL DEVELOPMENT

- AIMBE Public Policy Institute for Rising Leaders | 2025
- Best of Banff Science Communications Program | 2021
- Communicating Climate Change Workshop, Genspace | 2021

PUBLICATIONS

Academic (*Co-First Authors)

- **Fainor M***, Frehner SS*, Dulatov G, Ringwood R, Loftus H, Warner C, Bazaz A, Smith HE, Mauck RL, Erickson I, Gullbrand SE. A Human Progenitor Cell-Based Tissue Engineered Intervertebral Disc. *Tissue Engineering: Part A* 2025. DOI: 10.1177/19373341251373104
- Gullbrand SE, Kiapour A, Barrett C, **Fainor M**, Orozco BS, Hilliard R, Mauck RL, Hast MW, Schaer TP, Smith HE. Restoration of Physiologic Loading After Engineered Disc Implantation Mitigates Immobilization-Induced Facet Joint and Paraspinal Muscle Degeneration. *Acta Biomaterialia* 2025; 192: 128-139. DOI: 10.1016/j.actbio.2024.12.014
- Levis H, Lewis C, **Fainor M**, Lawal A, Stockham E, Weston J, Farhang N, Gullbrand SE, Bowles RD. Targeted CRISPR Regulation of ZNF865 Enhances Stem Cell Cartilage Deposition, Tissue Maturation Rates and Mechanical Properties in Engineered Intervertebral Discs. *Acta Biomaterialia* 2024; 191: 276-291. DOI: 10.1016/j.actbio.2024.11.007
- Shahed KS, **Fainor M**, Gullbrand SE, Hast MW, Manogharan G. Hybrid Additive Manufacturing for Zn-Mg Casting for Biomedical Application. *In Vitro Models* 2024; 3(4): 157-168. DOI: 10.1007/s44164-024-00077-0

PUBLICATIONS (Cont.)

Academic

- o Gullbrand SE, Orozco BS, **Fainor M**, Meadows K, Hilliard R, Boyes M, Mahindroo S, Mauck RL, Elliott DM, Schaer TP, Smith HE. Intervertebral Disc Degeneration Instigates Vertebral Endplate Remodeling and Facet Joint Pathology in a Large Animal Model. *European Cells and Materials* 2023; 47: 125-141. DOI:10.22203/eCM.v047a09
- o Muir VG, **Fainor M**, Orozco BS, Hilliard R, Boyes M, Smith HE, Mauck RL, Schaer T, Burdick JA, Gullbrand SE. Injectable Radiopaque Hyaluronic Acid Granular Hydrogels for Intervertebral Disc Repair. *Advanced Healthcare Materials* 2023; 13(25): 2303326. DOI: 10.1002/adhm.202303326
- o **Fainor M***, Orozco BS*, Muir VG, Mahindroo S, Gupta S, Mauck RL, Burdick JA, Smith HE, Gullbrand SE. Mechanical Crosstalk Between the Intervertebral Disc, Facet Joints, and Vertebral Endplate Following Acute Disc Injury in a Rabbit Model. *JOR SPINE* 2023; 6(4): e1287. DOI: 10.1002/jsp2.1287
- o **Fainor M**, Mahindroo S, Betz KR, Augustin J, Smith HE, Mauck RL, Gullbrand SE. A Tunable Calcium Phosphate Coating to Drive In Vivo Osseointegration of Composite Engineered Tissues. *Cells Tissues Organs* 2023; 212(5): 383-398. DOI: 10.1159/000528965
- o Gupta S, Xiao R, **Fainor M**, Mauck RL, Smith HE, Gullbrand SE. Level Dependent Alterations in Human Facet Cartilage Mechanics and Bone Morphometry with Spine Degeneration. *Journal of Orthopaedic Research* 2022; 41(3): 674-683. DOI: 10.1002/jor.25407
- o Camacho P, Behre A, **Fainor M**, Seims KB, Chow LW. Biomaterials Science Emerging Investigators Issue: Spatial Organization of Biochemical Cues in 3D-Printed Scaffolds to Guide Osteochondral Tissue Engineering. *Biomaterials Science* 2021; 9(2): 6813-6829. DOI: 10.1039/D1BM00859E
- o Camacho P, **Fainor M**, Seims KB, Tolbert JW, Chow LW. Fabricating Spatially Functionalized 3D-Printed Scaffolds for Osteochondral Tissue Engineering. *Journal of Biological Methods* 2021; 8(1): e146. DOI: 10.14440/jbm.2021.353

Popular Science Writing

- o **Fleshy Futures: Tissue Engineering the 21st Century** | Writer and Illustrator | 2024 - Present
Curated news and deep explorations of tissue engineering for those who care about biotechnology's impact on people and planet.
- o **"A good story is both foreign and familiar:" A parking lot chat with Corinne Okada Takara** | 2022
Biodesign Challenge Newsletter.

SELECTED PRESENTATIONS

Academic (*Presenting Author)

- o ***Fainor M**, Baranyai AJ, Mauck RL, Smith HE, Gullbrand SE. IL-1 β Does Not Exacerbate Cell Death in a Large-Scale Tissue-Engineered Intervertebral Disc. 2025 ORS PSRS Spine Research Symposium. Podium Talk.
- o ***Fainor M**, Bazaz A, Smith HE, Gullbrand SE. Assessing Cell Therapy Retention and Survival Across a Spectrum of Intervertebral Disc Degeneration. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2025. Poster Presentation.

SELECTED PRESENTATIONS (Cont.)

Academic (*Presenting Author)

- o *Orozco BS, **Fainor M**, Muir VG, Schaer TP, Burdick JA, Gullbrand SE. Restoration of Degenerative Disc Function Contributes to Facet Cartilage Recovery in a Large Animal Model. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2025. Poster Presentation.
- o ***Fainor M**, Bazaz A, Mauck RL, Smith HE, Gullbrand SE. Controlled Delivery of Deferoxamine in a Subcutaneous Model of Semi-Orthotopic Bone Formation. 2024 ORS PSRS 7th International Spine Research Symposium. Poster Presentation.
- o ***Fainor M**, Bazaz A, Augustin J, Mauck RL, Smith HE, Gullbrand SE. Engineering Composite Tissues: Coupling Angiogenesis and Osteogenesis via Material and Chemical Signals. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2024. Poster Presentation.
- o *Gullbrand SE & ***Fainor M**. Orthopaedic Research and the Quest to Repair Intervertebral Discs. La Salle University Biology Seminar Series. 2023. Invited Talk.
- o ***Fainor M**, Dulatova G, Frehner S, Smith HE, Mauck RL, Heaton WL, Gullbrand SE. Characterizing Discogenic Cell-Based Tissue-Engineered Disc Replacements. ORS PSRS Philadelphia Spine Research symposium. 2023. Poster Presentation.
- o ***Fainor M** & *Hast MW. Engineering the Intervertebral Disc: Modulating Cell Differentiation Through Material and Chemical Signaling. Cheyney University. 2023. Invited Talk.
- o **Fainor M**, *Augustin J, Mauck RL, Gullbrand SE. In Situ Delivery of Microspheres to Promote Local Vascularization in Composite Structures. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2023. Poster Presentation.
- o *Orozco BS, **Fainor M**, Muir V, Mahindroo S, Gupta S, Burdick J, Mauck RL, Smith HE, Gullbrand SE. Intervertebral Disc and Facet Crosstalk in a Rabbit Puncture Model of Disc Degeneration. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2023. Podium Presentation.
- o *Gullbrand SE, Orozco BS, **Fainor M**, Hilliard RL, Schaer TP, Elliott DM, Mauck RL, Smith HE. Restoration of Physiologic Loading Improves Outcomes in Engineered Disc Implanted-Spinal Motion Segments. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2023. Podium Presentation.
- o ***Fainor M**, Augustin J, Smith HE, Mauck RL, Gullbrand SE. Driving Osteogenesis in Composite Biomaterials Using Tunable Hydroxyapatite Surface Modifications. ORS PSRS 6th International Spine Research Symposium. 2022. Poster Presentation.
- o ***Fainor M**, Betz KR, Mahindroo S, Locke RC, Smith HE, Mauck RL, Gullbrand SE. The Effects of Hydroxyapatite Coating on Poly(caprolactone) Micromechanics and Mesenchymal Stem Cell Behavior. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2022. Poster Presentation.
- o ***Fainor M**, Mahindroo S, Gupta S, Mauck RL, Smith HE, Gullbrand SE. Intervertebral Disc and Facet Cross-Talk in a Rabbit Puncture Model of Spine Degeneration. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2022. Poster Presentation.
- o *Gullbrand SE, Mahindroo S, **Fainor M**, Meadows K, Barba A, Hopster K, Schaer TP, Elliott DM, Mauck RL, Smith HE. A Large Animal Model of Motion Segment Degeneration for Evaluation of Engineered Disc Replacements. Proceedings of the Annual Meeting of the Orthopaedic Research Society. 2022. Poster Presentation.

SELECTED PRESENTATIONS (Cont.)

Academic (*Presenting Author)

- ***Fainor M**, Camacho P, Behre A, Schaer TP, Chow LW. 3D Printing Peptide-Functionalized Scaffolds for Osteochondral Regeneration. David and Lorraine Freed Undergraduate Research Symposium. 2020. Podium Talk.
- ***Fainor M**, Camacho P, Behre A, Schaer TP, Chow LW. Characterizing Effects of Sterilization and Cell Culture on Peptide-Functionalized 3D-Printed Scaffolds. Biomedical Engineering Society Annual meeting. 2019. Poster Presentation.

Popular Science Communication

- **Q&A with a Tissue Engineer | 2024**
Presentation and Q&A with AP Biology students
Skype a Scientist | Nyack Public Schools
- **Communicating Science Panel | 2022**
University California San Diego
- **“Communicating Science Creatively” | 2021**
Workshop with the Biotechnology Society
King's College London
- **“Introduction to Orthopaedic Research” | 2021**
Presentation to Rowan undergraduates
Rowan University