Matthew Fainor

matthewfainor.com
mfainor@gmail.com

EDUCATION

2025 – Pres **University of Pennsylvania, School of Engineering and Applied Science**
PhD, Departments of Bioengineering and Orthopaedic Surgery
Advisor: Dr. Sarah E. Gullbrand, PhD

2016 – 2020 **Lehigh University, P.C. Rossin College of Engineering and Applied Science & College of Arts and Sciences**
BS, IDEAS (Integrated Degree in Engineering, Arts & Sciences)
Concentrations: Biomechanics & Biomaterials Engineering and Art & Design

EXPERIENCE

2020 – Pres **McKay Orthopaedic Research Lab (Sarah E. Gullbrand, PhD; Robert L. Mauck, PhD)**
Department of Orthopaedic Surgery, University of Pennsylvania
Translational Musculoskeletal Research Center, Department of Veterans Affairs

Research Engineer B & PhD Student	*Aug 2025 - Present*
Research Engineer B	*Dec 2022 - Aug 2025*
Research Engineer A	*Oct 2020 - Dec 2022*

My work translated a total tissue-engineered replacement intervertebral disc from the bench to preclinical large animal models. I led the development and execution of experiments developing more effective cell therapies, biomaterial scaffolds, and drug delivery systems for a variety of back pain treatments.

- Increased bone formation on our scaffolds in vivo by 38.02% via material and chemical modifications
- Managed administration for a team of 14, including safety reviews and $200,000 of annual budget
- Maintained BSL2 culture facility and 10 pieces of equipment, including the tissue processing core
- Mentored and trained 8 lab members with both their research projects and writing
- Edited and copyedited over 50 presentations and 10 manuscripts presenting Gullbrand Lab data
- Created a lab color-blind friendly color palette and branding guide for improved visual unity

2019 – 2020 **The Chow Lab for Modular Biomaterials (Lesley W. Chow, PhD)**
Department of Materials Science and Engineering, Lehigh University
GELH (Grants for Experiential Learning in Health) Scholar

The Chow Lab focuses on osteochondral regeneration via custom 3D-printed peptide-polymer conjugates.

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

2018 – 2020 **OSIsoft & Lehigh University Office of Sustainability Partnership**
Climate Science Educator and Design-Engineer

I built a database to manage Lehigh University's real-time utility data for all 196 buildings on campus to increase efficiency for campus energy staff and educate students. Me and my team hosted climate-science-focused events to promote sustainable behavior changes among students on and off campus.

- Designed and created a visual interface to manage energy efficiency and tell Lehigh's energy story
- Collaborated with a leadership team of 5 to supervise a team of 40 student volunteer educators
- Planned and executed 25 climate-science educational events engaging 800+ students annually

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AREAS OF EXPERTISE AND SELECTED SKILLS

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

AWARDS

- **2025 | 2nd Best Podium Presentation**
  For the talk "IL-1beta Does Not Exacerbate Cell Death in a Large-Scale Tissue-Engineered Intervertebral Disc" at the 2025 ORS PSRS Spine Research Symposium.
- **2024 | Katz Family Award in Orthopaedic Surgery**
  Recognizing work focusing on empathy, diversity, and cultural awareness in Orthopaedics at Penn
- **2019 | Undergraduate Student Sustainability Award**
  Recognizing outstanding work pursuing and implementing sustainably focused projects and education

PROFESSIONAL DEVELOPMENT

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

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
- Co-developed grant programs for external undergraduate students to attend scientific conferences

PUBLICATIONS

Academic (*Co-First Authors)

- **2026 |** Augustin JA*, Burt KG*, Barrett C, **Fainor M**, Orozco BS, Schaer TP, Smith HE, Mauck RL, Gullbrand SE. Revealing Neuroimmune Activation Within a Translational Goat Model of Intervertebral Disc Degeneration. *Cells (Special Issue: Novel Insights into Mechanism and Treatment of Degenerative Disc Disease)*; 15(3): 286. DOI: 10.3390/cells15030286
- **2025 | 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*. DOI: 10.1177/19373341251373104

PUBLICATIONS (Cont.)

Academic (*Co-First Authors)

- **2025 |** 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 Immboilization-Induced Facet Joint and Paraspinal Muscle Degeneration. *Acta Biomaterialia*; 192: 128-139. DOI: 10.1016/j.actbio.2024.12.014
- **2024 |** 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*; 191: 276-291. DOI: 10.1016/j.actbio.2024.11.007
- **2024 |** Shahed KS, **Fainor M**, Gullbrand SE, Hast MW, Manogharan G. Hybrid Additive Manufacturing for Zn-Mg Casting for Biomedical Application. *In Vitro Models*; 3(4): 157-168. DOI: 10.1007/s44164-024-00077-0
- **2023 |** 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*; 47: 125-141. DOI:10.22203/eCM.v047a09
- **2023 |** 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*; 13(25): 2303326. DOI: 10.1002/adhm.202303326
- **2023 | 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*; 6(4): e1287. DOI: 10.1002/jsp2.1287
- **2023 | 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*; 212(5): 383-398. DOI: 10.1159/000528965
- **2022 |** 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*; 41(3): 674-683. DOI: 10.1002/jor.25407
- **2021 |** 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*; 9(2): 6813-6829. DOI: 10.1039/D1BM00859E
- **2021 |** Camacho P, **Fainor M**, Seims KB, Tolbert JW, Chow LW. Fabricating Spatially Functionalized 3D-Printed Scaffolds for Osteochondral Tissue Engineering. *Journal of Biological Methods*; 8(1): e146. DOI: 10.14440/jbm.2021.353

Popular Science Writing

- **2024 - 2025 | Fleshy Futures: Tissue Engineering the 21st Century** | Writer and Illustrator
  Curated news and deep explorations of tissue engineering for those who care about biotechnology's impact on people and planet.

PUBLICATIONS (Cont.)

Popular Science Writing

- **2022 | "A good story is both foreign and familiar:" A parking lot chat with Corinne Okada Takara** Biodesign Challenge Newsletter.

SELECTED PRESENTATIONS

Academic Talks (*Presenting Author)

- **2026 | *Fainor M**, Levis H, Baranyai AJ, Bowles RD, Gullbrand SE. CRISPR Regulation of Noggin for Growth-Factor-Free Vertebral Endplate Tissue Engineering. Proceedings of the Annual Meeting of the Orthopaedic Research Society 2026. Podium Presentation.
- **2025 | *Fainor M**, Baranyai AJ, Mauck RL, Smith HE, Gullbrand SE. IL-1beta Does Not Exacerbate Cell Death in a Large-Scale Tissue-Engineered Intervertebral Disc. 2025 ORS PSRS Spine Research Symposium. Podium Presentation.
- **2023 |** *Gullbrand SE & ***Fainor M**. Orthopaedic Research and the Quest to Repair Intervertebral Discs. La Salle University Biology Seminar Series. Invited Talk.
- **2023 | *Fainor M** & *Hast MW. Engineering the Intervertebral Disc: Modulating Cell Differentiation Through Material and Chemical Signaling. Cheyney University. Invited Talk.
- **2023 |** *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.
- **2023 |** *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.
- **2022 | ***Zlotnick HM, Azar T, Kim SY, Lemmon EA, Peredo AP, Bautista CA, **Fainor M**, Mauck RL, Drazan JF, Taylor BL, Boerckel JD, Shore EM, Gullbrand SE. Reimagining Conferences as Platforms to Provide Early Research Exposure and Networking to Diverse Undergrads. Proceedings of the Annual Meeting of the Orthopaedic Research Society 2022. Podium Presentation.
- **2021 | *Fainor M** & *Nijsure M. Introduction to Orthopaedic Research. Rowan University. Invited Talk.
- **2020 | *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. Podium Talk.

Academic Posters (*Presenting Author)

- **2025 | *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 Posters (*Presenting Author)

- **2025 |** *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.
- **2024 | *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.
- **2024 | *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.
- **2023 | *Fainor M**, Dulatova G, Frehner S, Smith HE, Mauck RL, Heaton WL, Gullbrand SE. Characterizing Discogenic Cell-Based Tissue-Engineered Disc Replacements. 2023 ORS PSRS Philadelphia Spine Research symposium. Poster Presentation.
- **2023 | 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.
- **2022 | *Fainor M**, Augustin J, Smith HE, Mauck RL, Gullbrand SE. Driving Osteogenesis in Composite Biomaterials Using Tunable Hydroxyapatite Surface Modifications. 2022 ORS PSRS 6th International Spine Research Symposium. Poster Presentation.
- **2022 | *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.
- **2022 | *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.
- **2019 | *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

- **2024 | “Q&A With a Tissue Engineer”**
  Presentation and Q&A with AP Biology Students, Skype a Scientist & Nyack Public Schools
- **2022 | Communicating Science Panel**
  University California San Diego
- **2021 | “Communicating Science Creatively”**
  Workshop with the Biotechnology Society, King’s College London