# CAMERON B. RENTERIA, Ph.D.

Curriculum Vitae

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## EDUCATION

**University of Washington**, Seattle, WA — September 2018 – August 2023
*Department of Materials Science & Engineering*
**Doctor of Philosophy (Ph.D.)**
Dissertation: *Structure-Property Relationships in Natural Materials: The Case of Tooth Enamel*
Advisor: Dr. Dwayne D. Arola

**University of Washington**, Seattle, WA — September 2018 – March 2020
*Department of Materials Science & Engineering*
**Master of Science (M.S.)**

**University of Nevada, Reno**, NV — August 2015 – May 2018
*Department of Chemical & Materials Engineering*
**Bachelor of Science (B.S.), Cum Laude** (Biomedical Emphasis)
*Minor in Chemistry* (Analytical & Organic Option)
*Minor in Biology*

**College of Southern Nevada**, Las Vegas, NV — August 2012 – August 2015
*Department of Physical Sciences*
Undergraduate Student

## RESEARCH INTERESTS

Predictive design-for-manufacturing (DFM) tools for ceramic additive manufacturing combining computational and experimental approaches; direct-ink writing and post-processing of damage-tolerant ceramic and ceramic-composite parts. *Current work:* AI-accelerated synchrotron micro/nano-CT and X-ray scattering for hierarchical-ceramic (enamel) characterization; computed-tomography-based non-destructive testing (NDT); deep-learning PIV and deterministic feature-to-CAD pipelines that inherit microstructural parameters from measurement and emit printable architectures with no fitting; SLA + polymer-backfill realization of damage-tolerant lattices; in-situ dual CT / IR-thermography monitoring of additive manufacturing (collaborative metal-AM project for in-situ defect detection); atom probe tomography (APT), ToF-SIMS, and XPS for nanoscale compositional and point-defect metrology in apatitic ceramics; rheometry, DLS, zeta-potential, FTIR, and Raman characterization of biological-ceramic and colloidal systems; AI/ML-enabled automation (U-Net segmentation, self-supervised denoising, physics-informed ML) for autonomous processing of large multi-modal AM and characterization datasets; experimental equipment design (Python, G-code controls, parametric CAD, FEA) for custom in-situ AM and process-monitoring stations. *Topics I would like to extend my expertise and workflows into:* in-situ observation of densification, including cold sintering and ultra-fast high-temperature sintering; point-defect metrology in functional and structural oxide ceramics; closed-loop coupling of ink rheology and zeta-potential to print fidelity; collaborative user science at NIST and DOE light sources.

## PROFESSIONAL SUMMARY

Materials scientist with seven-plus years of advanced materials characterization experience and 5+ years building AI-driven workflows for automated science across synchrotron beamline experiments and additive-manufacturing pipelines. Architect of a measurement-driven ceramic design-for-manufacturing (DFM) pipeline that converts synchrotron micro-CT of a hierarchical biological ceramic (mammalian enamel, 96 wt% hydroxyapatite) into a parametric, printable decussated lattice with linear-elastic FEA crack-deflection predictions and an SLA + polymer-backfill realization, a working instance of *predictive tools for ceramic AM combining computational and experimental approaches*. Co-author on direct-ink writing of bioinspired ceramics (Guillen et al., MS&T24). Hands-on across rheometry, dynamic light scattering (DLS), zeta potential, FTIR, Raman, SAXS/WAXS, atom probe tomography for point-defect metrology, and synchrotron $\mu$CT/nano-CT (APS 2-BM, 32-ID-C; ALS 8.3.2). Directs a six-engineer team building custom experimental instrumentation and controls (Python-driven hardware, integrated CAD/FEA, sensor stacks) under ISO 13485/GMP-aligned process documentation. 10+ peer-reviewed publications, an issued partner patent, a U.S. provisional patent, and active collaborations across four DOE national laboratories. U.S. citizen, eligible for the NRC Research Associateship Program.

## RESEARCH & EMPLOYMENT HISTORY

**NIH-NIDCR T90 Postdoctoral Fellow**

*University of Washington, Materials Science & Engineering* September 2023 – Present

- Built end-to-end ceramic-AM design pipeline: synchrotron micro-CT → deep-learning particle image velocimetry (DL–PIV) → deterministic feature-to-CAD mapping → parametric decussated lattice → linear-elastic FEA with Wang-style crack-deflection criterion → SLA print plus pourable polymer backfill, with $\mu$CT manufacturing-fidelity QC; *Matter* (Cell Press) presubmission inquiry earned a conditional invitation to submit on the strength of its conceptual advance for ceramic AM
- Reconstructed 2,423 complete 3D rod trajectories at 0.345 $\mu$m isotropic resolution; derived a four-band SOM-segmented orientation tensor (mean directions 2.3°, 12.6°, 122.4°, −167.6°; Hunter–Schreger periodicity 56.3 $\mu$m by FFT) and propagated it directly into CAD design parameters with no free tuning
- Co-author on *Direct Ink Write Printing of Novel Bioinspired Ceramics* (Guillen et al., MS&T24, 2024), translating the decussated-lattice architecture into a ceramic DIW process with INL collaborators
- Designed and executed synchrotron micro-CT and nano-CT experiments at APS Beamlines 2-BM and 32-ID-C and ALS Beamline 8.3.2; configured detector–sample distance, beam energy, and acquisition through EPICS-backed PVs at user facilities
- Developed self-supervised deep-learning denoising (Noise2Inverse framework) reducing noise amplitude by 375% while preserving structural boundaries; achieved >85% Dice with a U-Net segmentation pipeline on synchrotron CT volumes; cut manual analysis time by 98%
- Built an unsupervised fabric-segmentation pipeline (SOMs, k-means, GMM, multi-Otsu over Gabor filter responses, structure-tensor orientation, and density-gradient features) for noise-limited X-ray data; integrated GPU-accelerated training (PyTorch DDP) with physics-informed regularization
- Coordinate research across four DOE national laboratories (ANL, LBNL, PNNL, INL); collaborate directly with Argonne staff (A. Yunker, V. Nikitin) and INL staff (D. Guillen) on AI-driven workflows for synchrotron and DIW ceramic AM datasets
- Manage $1M+ regulated R&D programs; mentor graduate and undergraduate researchers on synchrotron techniques, ML methods, and safe laboratory operations

**Data Scientist & Engineering Technical Lead**

*Equicare Solutions LLC, Seattle, WA* November 2023 – Present

- Direct a cross-functional team of six engineers building custom experimental hardware: Python-driven controllers, sensor integration, parametric CAD (Fusion 360, SolidWorks, CadQuery), FEA-informed iteration, and image/video-processing pipelines (ImageJ, scikit-image, OpenCV)
- Architected an autonomous multimodal X-ray scattering analysis pipeline (SAXS, WAXS, GIWAXS, GISAXS) with GPU-accelerated differentiable fitting, Richardson–Lucy deconvolution, and Kalman-filter temporal regularization; 98% reduction in analysis time
- Built a VAE-based anomaly detector flagging device drift 3–5 frames before human-observable failure; delivered 80% improvement in device reliability
- Authored ISO 13485 / 21 CFR 820 / GMP-aligned SOPs, calibration protocols, and an IQ/OQ/PQ-style validation stack (URS → VP → qualification → control plans, FMEA)
- Co-inventor on U.S. provisional patent: *Mechanochromic Material and Method for Detecting Early IV Failure Through Swelling Detection* (UW CoMotion Docket No. 080097-1549750, filed 2026)
- Secured Washington Research Foundation Phase I grant ($109,778, Nov 2025 – Oct 2026)

**Lead Graduate Research Assistant**

*Laboratory for Advanced Materials & Processes (LAMPR), University of Washington* August 2018 – September 2023
*Graduate Research & Teaching Assistant to Dr. D. Arola*

- Led a five-year, $800k Colgate-Palmolive industry collaboration on multi-technique characterization of hierarchical biological ceramics (tooth enamel and dentin); contributed research informing issued U.S. partner patent US-20230038764-A1 (Colgate-Palmolive)
- Integrated synchrotron micro-CT, SEM/EDS, EBSD, TEM, XRD, FTIR, Raman, DLS, rheometry, and thermal/mechanical analysis (DMA, NanoDMA, DSC, TGA, nanoindentation) for structure–property studies of hierarchical ceramic (mineral–organic) composites (enamel)
- Developed and verified ASTM test methods D638 (tensile), D790 (flexural), D695 (compression), E466 (fatigue), E399 (compact-tension fracture toughness), and E1131 (TGA compositional analysis); authored SOPs and calibration protocols

- Built AI-driven workflows for automated analysis of multimodal X-ray and microstructural data (SOMs, k-means, machine-vision); published first-author work on data-driven structure–property relationships in biological apatite composites
- Performed sample preparation under vacuum, inert and controlled atmosphere, and moisture-sensitive conditions; performed failure analysis and root cause investigations on fractured composite specimens
- Established research collaborations now spanning four DOE national laboratories (ANL, LBNL, PNNL, INL); 20+ presentations at national and international conferences; five years as teaching assistant

**Undergraduate Research Assistant**

*Materials & Electrochemical Engineering Research Lab, University of Nevada, Reno* November 2016 – May 2018
*Research Assistant to Dr. D. Chidambaram*

- Performed electrochemical polarization, potentiodynamic-scan, and zeta-potential analysis on Ti-6Al-4V to evaluate surface-charge and corrosion behavior of laser-processed metallic alloys
- Designed custom sample mounts and developed reproducible experimental and characterization protocols

**Undergraduate Research Assistant**

*Dr. Mario Alpuche's Research Lab, University of Nevada, Reno* July 2017 – August 2018

- Fabricated ultra-microelectrodes from singular carbon-fiber strands using fiber-optic microscopy for electrochemical sensing applications

## TECHNICAL SKILLS

**Ceramic / Colloidal Characterization:** Hydroxyapatite/biomineral systems, rheometry, dynamic light scattering (DLS/PCS), zeta potential, FTIR, Raman, optical and confocal microscopy, fluorescence microscopy, sample preparation under vacuum, inert and controlled atmosphere, moisture-sensitive handling

**Additive Manufacturing & Post-Processing:** SLA + polymer-backfill composite realization, FDM, LPBF, E-Beam, CNC machining, laser cutting; collaboration on direct-ink writing of bioinspired ceramics; manufacturability clamps and feasibility-polygon constraints (BRIDGE_DIAMETER < ROD_DIAMETER, CENTER_SPACING > ROD_DIAMETER, fillet/junction sphere logic) auditable through provenance JSON

**X-ray & Advanced Characterization:** Synchrotron nano-CT and micro-CT (APS Beamlines 2-BM, 32-ID-C; ALS Beamline 8.3.2); SAXS, WAXS, GIWAXS, GISAXS experimental design, data acquisition, and autonomous analysis; XRD; TomoPy reconstruction; Richardson–Lucy deconvolution; EPICS-backed beamline configuration; Bluesky/Tiled data streaming; DOE user-facility operations

**Predictive Modeling, AI/ML & Image/Video Processing:** Python (expert), PyTorch, PyTorch DDP, TensorFlow, CUDA/GPU workflows (Linux/WSL2), self-supervised learning (Noise2Inverse, 375% noise reduction), U-Net segmentation (>85% Dice), DL–PIV, attention-based segmentation, unsupervised methods (SOMs, k-means, GMM, multi-Otsu), physics-informed neural networks (PINNs), differentiable fitting, Kalman filtering, CUSUM, Gabor filter and structure-tensor feature extraction, ImageJ, scikit-image, OpenCV, statistical modeling, design of experiments (DOE), uncertainty quantification

**Scientific Computing & Software:** Linux/Unix (WSL2, Ubuntu), Git, CMake, CUDA, scientific Python stack (NumPy, SciPy, Pandas, Matplotlib, scikit-learn), MATLAB, R, C#, LaTeX, MathCAD; documentation-driven implementation of new instruments and pipelines

**Modeling & Simulation:** Finite-element analysis (ANSYS, FEniCS, SfePy, EasyFEA); parametric CAD (Autodesk Fusion 360, SolidWorks, CadQuery, Catia/3DExperience); deterministic feature-to-CAD mappers with provenance/clamp logging

**Experimental Instrumentation & Controls:** Python, G-code (CNC and AM), hardware controller and sensor integration, custom fixture and sample-environment design, electronic assembly prototyping, generative DFM

**Advanced Materials Characterization (broader inventory):** SEM/EDS/EBSD, TEM, atom-probe tomography (APT), XPS, ToF-SIMS, AFM, DMA, NanoDMA, DSC, TGA, nanoindentation, Vickers hardness, indentation fracture resistance, profilometry, mechanical testing (tensile, compression, fracture toughness, fatigue, scratch, wear); failure analysis and root cause analysis; multi-modal data integration

**Process Control & Documentation:** SOPs, calibration protocols, ISO 13485 / 21 CFR Part 820 (FDA Medical Device QSR) / GMP-aligned documentation; URS, VP, IQ/OQ/PQ, FMEA, control plans; supplier qualification and

material validation; safety compliance (NIH Biomedical Research Integrity Program, 2025); R&D lab setup, inventory management, workflow optimization

## CURRENT PROJECTS AND COLLABORATIONS

**Biomimetic Pipeline: Predictive Ceramic-AM Design from Synchrotron CT**

End-to-end zero-free-parameter pipeline wrapping a CadQuery + Gmsh + sfepy stack. Ingests measured morphometrics (rod diameter, center spacing, bridge layers, decussation amplitude, fabric tensor, tortuosity) from an upstream DL–PIV characterization pipeline (0.345 $\mu$m isotropic synchrotron $\mu$CT $\rightarrow$ U-Net segmentation + PIV $\rightarrow$ 2,423 complete 3D rod trajectories $\rightarrow$ four-band SOM orientation tensor, Hunter–Schreger periodicity 56.3 $\mu$m, Woodcock C = 3.604, mean rod tortuosity 1.099), deterministically maps them into CAD parameters, generates STEP/STL geometry, runs linear-elastic FEA solving for the strain that produces a 200 MPa target von-Mises stress, and emits a 42-field metrics JSON including specific toughness, energy absorption, stress-concentration factor, and crack-deflection streamline tortuosity (mean 2.30, p90 7.09 on the lion digital twin). Provenance and manufacturability clamps logged for full auditability. Five YAML-configurable objectives; Optuna Bayesian optimization and closed-loop biomimicry modes that reverse-map CAD optima into morphometric ranges to look for in specimens. **Manuscript in preparation for *Matter* (Cell Press)** framing the work as ceramic AM; presubmission inquiry returned a **conditional invitation to submit from the Editor-in-Chief**.

**Bioinspired Ceramic AM Collaboration — Idaho National Laboratory (D. P. Guillen)**

Long-running collaboration with Donna Post Guillen (Distinguished Research Engineer, Idaho National Laboratory) and her group on bioinspired ceramic additive manufacturing, synchrotron characterization of biological ceramic templates, and direct-ink-write process development. Co-author on three peer-reviewed Renteria–Guillen publications (Marsico/Renteria/Guillen, *Acta Biomaterialia* 2024; Guo/Guillen/Renteria, *Acta Biomaterialia* 2024; Marsico/Renteria/Guillen, *Small Structures* 2025), and co-presenter on Guillen et al., *Direct Ink Write Printing of Novel Bioinspired Ceramics* (MS&T24, 2024). Contributing collaborator (not listed author) on Thompson, Cutts, Huddleston, Tucker, Guillen, *Evaluating fracture behavior of bioinspired alumina–YSZ composites through static and dynamic mechanical testing*, *Next Materials* 11, 101952 (2026) — contributed the upstream synchrotron CT characterization and microstructural / architectural design parameters from the prior Acta Biomaterialia work that informed the alumina–YSZ composite architecture under test. Additional INL manuscripts currently in revision.

**APS Nano-CT Denoising and Reconstruction (Noise2Inverse) — Argonne National Laboratory**

Built a self-supervised Noise2Inverse denoising and TomoPy/TomocuPy reconstruction pipeline for APS 32-ID nano-CT (20.6 nm pixel, 8.0 keV, Zernike phase-contrast with 10$\times$ Fresnel zone plate) on biological ceramic specimens; achieved 375% noise-amplitude reduction while preserving structural boundaries, enabling robust segmentation of previously low-contrast interfaces. Direct collaboration with Argonne staff Austin Yunker (Assistant Computer Scientist) and Viktor Nikitin (Assistant Physicist, X-ray Science Division); pipeline now extending to ALS Beamline 8.3.2 micro-CT.

**Synchrotron Nano-CT Manuscript on Enamel Hierarchical Architecture**

First-author manuscript submitted to *Materials & Design* (2026) on AI-driven segmentation and denoising of synchrotron nano-CT data resolving the nanoscale architecture of mammalian enamel. Combines Noise2Inverse denoising, U-Net segmentation (>85% Dice), and SOM-based fabric analysis; produces quantitative morphometric outputs and STL/mesh geometry that feed directly into the biomimetic ceramic-AM design pipeline above.

**Operando X-ray Scattering Proposal at APS / GISAXS Distortion Analysis**

Lead author on an APS beamtime proposal for operando small/wide-angle X-ray scattering of engineered polymer systems, and on an accompanying GISAXS distortion-analysis report integrating Richardson–Lucy deconvolution, Kalman-filter temporal regularization, and ML-driven peak fitting in autonomous SAXS/WAXS/GIWAXS/GISAXS workflows. Extends the synchrotron-CT toolkit into scattering modalities directly applicable to ceramic-ink rheo-structural characterization.

**Atom Probe Tomography of Enamel Aging — PNNL Collaboration**

Co-author on an in-revision *Science Advances*-formatted manuscript on atom probe tomography (APT) of enamel aging, providing sub-nanometer compositional and point-defect metrology in biological hydroxyapatite, with PNNL collaborators A. Devaraj, S. Taylor, and B. Ginovska. Contributed APT data analysis and an APTViz-based visualization workflow resolving nanoscale compositional gradients.

**ToF-SIMS Spatial-Chemical Analysis of Tooth Enamel and Dentin**

ML-driven analysis of ToF-SIMS spatial-chemical maps for organic-mineral phase distinction and trace-element localization in apatitic biological ceramics. Combines unsupervised clustering and multi-channel ion-image fusion to

localize organic-rich interfaces and impurity-rich domains; outputs cross-validate compositional claims in the nano-CT and APT manuscripts.

**Colgate-Palmolive Phase V — Whitening Response Predictive Modeling**

ML-driven analysis of a 28-tooth $H_2O_2$ whitening cohort (89% responder rate; T0–T5 timepoints) identifying microstructural predictors of CIELab whitening response across XRD hydroxyapatite crystallography, surface profilometry (Ra, Rz, Rk, Rpk, Rvk), interior CIELab spatial maps, and Raman spectra. Team includes J. Grimm (PNNL), K. Tang, and PI D. Arola; findings report compiled March 2026 for the Colgate-UW industry program.

**ML-Driven Discovery in Li-ion Battery Rate-Limiting Mechanisms**

Collaborative ML follow-up to Brischetto et al., *J. Electrochem. Soc.* 172, 040531 (2025). Built a classifier and latent-variable discovery pipeline on the NMC622/LFP rate-performance dataset (StratifiedGroupKFold cross-validation, scikit-learn + PyTorch) that surfaces rate-limiting mechanism transitions across cell chemistries. Output target is a joint methods paper.

**IV-Safe Swell™ — Equicare Mechanochromic IV-Failure Detection**

Lead a six-engineer team at Equicare Solutions building a custom Python-controlled hardware platform with integrated CAD/FEA prototyping and ISO 13485 / 21 CFR 820 / GMP-aligned documentation; achieved 80% improvement in device reliability through closed-loop failure-analysis iteration. Co-inventor on U.S. provisional patent (UW CoMotion, 2026); co-secured Washington Research Foundation Phase I grant ($109,778). Demonstrates equipment-design, process-control, and validation-stack capabilities directly transferable to in-situ AM and process-monitoring stations.

## PUBLICATIONS

*Google Scholar Profile:* https://scholar.google.com/citations?user=kLYnhl8AAAAJ

**Manuscripts Submitted / In Preparation**

**C. Renteria**, J.R. Grimm, A. Yunker, C. Marsico, D.P. Guillen, V. Nikitin, D.D. Arola. Deep learning-driven segmentation of enamel nanoscale architecture from synchrotron computed tomography for bioinspired material design. *Materials & Design.* (Submitted, 2026)

**C. Renteria**, J.R. Grimm, A. Yunker, C. Marsico, D.P. Guillen, V. Nikitin, D.D. Arola. Zero-free-parameter biomimetic ceramic lattices from synchrotron microstructure: designing helically decussated architectures for J-shaped crack resistance. ***Matter*** (Cell Press). **In preparation, 2026 — presubmission inquiry returned a conditional invitation to submit from the Editor-in-Chief.**

**C. Renteria**, J.R. Grimm, A. Yunker, C. Marsico, D.P. Guillen, V. Nikitin, D.D. Arola. Synchrotron microCT-driven segmentation and parametric modeling of enamel decussation for bioinspired material design and manufacturability. *NPJ Computational Materials.* (In preparation, 2026)

**C. Renteria**, J.M. Fernandez-Arteaga, J. Grimm, W. Yan, Y. Huang, D. Arola. Application of machine learning techniques to investigate structure-property relationships in relation to enamel aesthetics. *Journal of Esthetic and Restorative Dentistry.* (In preparation, 2026)

**C. Renteria**, Q. Ruan, S. Lavender, D. Arola. On Restoring the Durability of Senior Enamel. *Journal of the Mechanical Behavior of Biomedical Materials.* (Accepted 2025, held by collaborators for internal review)

**Peer-Reviewed Journal Articles**

C. Marsico, **C. Renteria**, J.R. Grimm, J. Fernandez-Arteaga, D. Guillen, D. Arola. A Machine Learning Approach to Quantitative Analysis of Enamel Microstructure from Scanning Electron Microscopy Images. *Small Structures.* 2025. DOI: 10.1002/sstr.202400510

C. Marsico, J.R. Grimm, **C. Renteria**, D.P. Guillen, K. Tang, V. Nikitin, D.D. Arola. Decussation Patterning in Mammalian Enamel. *Acta Biomaterialia.* 2024, 178, 208-220. DOI: 10.1016/j.actbio.2024.08.005

Z. Guo, D.P. Guillen, J.R. Grimm, **C. Renteria**, C. Marsico, V. Nikitin, D. Arola. Quantitative characterization of enamel decussation in mammalian teeth. *Acta Biomaterialia.* 2024, 181, 263-274. DOI: 10.1016/j.actbio.2024.03.022

**C. Renteria**, W. Yan, Y. Huang, D. Arola. Contributions to enamel durability with aging: An application of data science tools. *Journal of the Mechanical Behavior of Biomedical Materials.* 2022. DOI: 10.1016/j.jmbbm.2022.105147

W. Yan, E. Jiang, **C. Renteria**, A. Paranjpe, D. Arola, L. Liao, X. Ren, H. Zhang. Odontoblast Apoptosis and Intratubular Mineralization of Sclerotic Dentin with Aging. *Archives of Oral Biology.* 2022. DOI: 10.1016/j.archoralbio.2022.105371

**C. Renteria**, J.M. Fernandez-Arteaga, J. Grimm, E.A. Ossa, D. Arola. Mammalian enamel: A universal tissue and diverse source of inspiration. *Acta Biomaterialia*. 2021, 136, 402-411. DOI: 10.1016/j.actbio.2021.09.016

W. Yan, **C. Renteria**, Y. Huang, D. Arola. A machine learning approach to investigate the materials science of enamel aging. *Dental Materials*. 2021. DOI: 10.1016/j.dental.2021.09.006

S. Ghods, S. Waddell, E. Weller, **C. Renteria**, H.-Y. Jiang, J.M. Janak, S.S. Mao, T.J. Linley, D. Arola. On the regeneration of fish scales: structure and mechanical behavior. *Journal of Experimental Biology*. 2020. DOI: 10.1242/jeb.211144

## PATENTS

U.S. provisional patent: *Mechanochromic Material and Method for Detecting Early IV Failure Through Swelling Detection.* Co-inventors: L. Guio, G. Valentine, **C. Renteria**, S. Kakar, W. Kitchings. UW CoMotion Attorney Docket No. 080097-1549750 (053400US); Client Ref. 50623.01US1. Filed 2026.

U.S. partner patent US-20230038764-A1 (Colgate-Palmolive) – contributing research from Ph.D. work on hierarchical biological ceramics.

## CONFERENCE PRESENTATIONS

*Note: Presenting author indicated in bold*

**2026**

**C. Renteria**, J. Grimm, A. Yunker, K. Tang, C. Marsico, J. Fernández-Arteaga, V. Nikitin, D. Arola. Exploring the Microstructure of Tooth Enamel Across Length Scales using Synchrotron Tomography and Machine Learning. IADR General Session & Exhibition, San Diego, CA, March 25-27, 2026. Oral Presentation.

**C. Renteria**, K. Tang, J. Grimm, D. Arola. Aging and Aesthetics of Tooth Enamel: Machine Learning Analysis of Contributions from Microstructure. TMS Annual Meeting & Exhibition, Las Vegas, NV, March 23-27, 2026. Oral Presentation.

**C. Renteria**. AI-Driven Deep Learning Pipelines for High-Fidelity Denoising and Segmentation of Synchrotron CT in Bioinspired Restoratives. University of Washington School of Dentistry Research Symposium, Seattle, WA, January 28, 2026. Oral Presentation.

**2025**

**C. Renteria**, J. Grimm, C. Marsico, J. Fernández-Arteaga, D. Guillen, V. Nikitin, D. Parkinson, D. Arola. The 3D Structure of Dental Enamel: Synchrotron CT Insights and Property Relationships. 2025 TMS Annual Meeting & Exhibition, Las Vegas, NV, March 23-27, 2025. Oral Presentation.

D. Guillen, Z. Guo, B. Huddleston, J. Grimm, **C. Renteria**, D. Parkinson, V. Nikitin, C. Marsico, D. Arola. Unlocking the Secrets of Enamel: Advancing Fracture-Resistant Ceramics. MS&T25: Materials Science & Technology, Pittsburgh, PA, October 5-9, 2025. Oral Presentation.

J. Grimm, **C. Renteria**, K. Tang, S. Taylor, A. Devaraj, D. Arola. Carbon or Carbonate? Distinguishing Carbon Sources in Biominerals by Atom Probe Tomography. 2025 TMS Annual Meeting & Exhibition, Las Vegas, NV, March 23-27, 2025. Oral Presentation.

J. Grimm, **C. Renteria**, C. Marsico, K. Tang, V. Nikitin, D. Guillen, D. Arola. Improving Our Three-Dimensional Understanding of Decussation via Automated Segmentation & Synchrotron Computed Tomography. Enamel 11 Research Conference, Paris, France, October 13-17, 2025. Oral Presentation.

J. Grimm, K. Tang, **C. Renteria**, S. Taylor, B. Ginovska, A. Devaraj, D. Arola. A Nanoscale Perspective of Organic and Mineral Composition in Human Primary and Permanent Enamel. Enamel 11 Research Conference, Paris, France, October 13-17, 2025. Poster Presentation.

**2024**

**D. Guillen**, K. Cutts, K. Fujimoto, B. Huddleston, Z. Guo, D. Tucker, J. Grimm, **C. Renteria**, C. Marsico, D. Arola, V. Nikitin, D. Parkinson. **Direct Ink Write Printing of Novel Bioinspired Ceramics.** MS&T24: Materials Science & Technology, Pittsburgh, PA, September 29 – October 3, 2024. Oral Presentation.

J. Grimm, **C. Renteria**, A. Devaraj, D. Arola. A Novel Compositional Comparison of Crocodilian, Murine, and Human Enamels at the Nanocrystal Scale. 2024 TMS Annual Meeting & Exhibition, Orlando, FL, March 3-7, 2024. Oral Presentation.

**C. Renteria**, J. Grimm, C. Marsico, J. Fernández-Arteaga, A. Devaraj, D. Arola. Exploring the 3-Dimensional Structure and Composition of Dental Enamel at the Nanoscale. 2024 TMS Annual Meeting & Exhibition, Orlando, FL, March 3-7, 2024. Oral Presentation.

I. Carpenter, **C. Renteria**, J. Grimm, D. Guatelli-Steinberg, S. McGraw, D. Arola. A Comparison of Tooth Enamel Across Primates: A Lesson in Materials Design for Function. 2024 TMS Annual Meeting & Exhibition, Orlando, FL, March 3-7, 2024. Oral Presentation.

D. Guillen, Z. Guo, J. Grimm, **C. Renteria**, D. Arola, V. Nikitin. Insights on the Microstructure of Mammalian Enamel From Synchrotron X-ray Tomography. 2024 TMS Annual Meeting & Exhibition, Orlando, FL, March 3-7, 2024. Oral Presentation.

**2023**

J. Grimm, **C. Renteria**, A. Devaraj, D. Arola. Nanoscale Differences in Tooth Enamel with Aging by Atom Probe Tomography. TMS 2023, San Diego, CA, March 19-23, 2023. Oral Presentation.

C. Marsico, **C. Renteria**, J. Grimm, S. Estrada-Hernandez, J.M. Fernandez-Artega, D. Arola, E.A. Ossa. Unraveling the Mystery of Mammalian Enamel Microstructure. TMS 2023, San Diego, CA, March 19-23, 2023. Oral Presentation.

**2022**

**C. Renteria**, J.M. Fernandez-Artega, J. Grimm, S. Estrada-Hernandez, E.A. Ossa, D. Arola. Characterization and Modeling of Mature Mammalian Enamel: A Bioinspiration Blueprint. The 10th International Symposium of Dental Enamel (Enamel 10), Wheeling, WV, May 8-12, 2022. Oral Presentation.

**C. Renteria**, S. Estrada-Hernandez, J.M. Fernandez-Artega, D. Arola, E.A. Ossa. Decussation in Human Enamel: Descriptions of the Complex Pattern of the Enamel Rods. TMS 2022, Anaheim, CA, March 1-3, 2022. Oral Presentation.

**2021**

**C. Renteria**, J.M. Fernandez-Artega, D. Arola, E.A. Ossa. Microstructural Variations in Mammalian Enamel: An Exploration of Decussation from the Micro- to the Macro-scale. TMS 2021, San Diego, CA, March 15-18, 2021. Virtual Oral Presentation.

J. Grimm, **C. Renteria**, D. Arola, S. Camacho, X. Sanchez-Martinez. On the Structure and Mechanical Properties of Aprismatic Enamel in Crocodilian Teeth. TMS 2021, San Diego, CA, March 15-18, 2021. Virtual Oral Presentation.

**2020**

**C. Renteria**, D. Arola, J.M. Fernandez-Artega, C. Marsico, E.A. Ossa. Decussation Patterns in Mammalian Teeth Across Bite Force Regimes. TMS 2020, San Diego, CA, February 23-27, 2020. Oral Presentation.

**C. Renteria**, W. Yan, D. Arola, J.M. Fernandez-Artega, S. Jiang. Age-Specific Composition and Mechanical Property Profiles in Human Enamel. IADR 2020, Washington, D.C., March 18-21, 2020. Poster Presentation.

**C. Renteria**, S. Ghods, D. Arola, S. Waddell, E. Weller, H.-Y. Jiang, J.M. Janak, S.S. Mao, T.J. Linley. Structure and Mechanical Behavior of Regenerated Fish Scales. TMS 2020, San Diego, CA, February 23-27, 2020. Oral Presentation.

**2017**

**C. Renteria**, D. Chidambaram, Y. Liao, X. Zhang. Surface Characterization and Corrosion Behavior of Ti-6Al-4V Prepared By Advanced Laser Assisted Manufacturing Processes. 25th Annual National Ronald E. McNair Scholars Research Symposium, Berkeley, CA, July 27-30, 2017. Poster Presentation.

**C. Renteria**, D. Chidambaram, Y. Liao, X. Zhang. Surface Characterization and Corrosion Behavior of Ti-6Al-4V Prepared By Advanced Laser Assisted Manufacturing Processes. 1st Annual Ronald E. McNair Scholars Research Symposium, Reno, NV, August 4, 2017. Oral Presentation.

**C. Renteria**, D. Chidambaram, Y. Liao, X. Zhang. Corrosion Behavior and Surface Characterization of Ti-6Al-4V Prepared By Advanced Laser Assisted Processing. NSF EPSCoR/NIH INBRE Poster Meeting, Reno, NV, August 9, 2017. Poster Presentation.

## FUNDING & GRANT ACTIVITIES

**Grant Submissions (2025-2026):**

- NIH K99/R00 Pathway to Independence Award – *Bridging Oral Health and Material Engineering through Deep Learning-Driven Enamel Insights* (Submitted October 12, 2025) – Primary focus
- Other applicable K-Series grants (K01, K07, K08, K22, K23, K25, K76)

**Fellowship Awards:**

- NIH-NIDCR T90 DE021984 – Comprehensive Training in Inter-Disciplinary Oral Health Research (2023-Present)
- National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) – Offered 2020
- Thomas Stobbe Fellowship – University of Washington (2018)

**Grant Writing Contributions:**

- Washington Research Foundation (WRF) Phase I Grant – IV-Safe Swell™: A Passive Indicator for IV Failure via Skin Strain Detection (Funded, $109,778, November 2025 – October 2026)
- Colgate-Palmolive research grants (multiple funded awards exceeding $1,000,000)
- Life Science Washington Institute Washington Competes Grant (funded) – CoMotion entrepreneurial space collaboration

## ACADEMIC AWARDS & ACHIEVEMENTS

**NIH-NIDCR T90 Postdoctoral Fellowship** (2023-Present) – Comprehensive Training in Inter-Disciplinary Oral Health Research

**Graduate Student Equity & Excellence (GSEE) Tuition and Supplemental Award** (2022-2023) – University of Washington

**National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP)** (Offered 2020)

**Thomas Stobbe Fellowship** (2018) – University of Washington

**NACE International (Southern Nevada Section) Research Scholarship** (2017)

**Introduction to Graduate Education at Northwestern University (IGEN) Selection** (2017)

**Ronald E. McNair Post Baccalaureate Achievement Program** (2016-2018)

**College of Engineering Dean's List** (Fall 2015 – Spring 2017) – University of Nevada, Reno

**College of Southern Nevada Biology Student of the Year** (2014-2015)

**College of Southern Nevada President's List** (Fall 2013 – Spring 2015)

## PROFESSIONAL MEMBERSHIPS & SERVICE

**DOE User Facility Experience:** Advanced Photon Source – Beamlines 2-BM, 32-ID-C (Argonne National Lab); Advanced Light Source – Beamline 8.3.2 (Lawrence Berkeley National Lab)

**Active Peer Reviewer:** Acta Biomaterialia, ASME Journal of Biomechanical Engineering, Journal of Prosthodontics

**Materials Research Society (MRS)** 2018 – Present

**Society for Biomaterials (SFB)** 2018 – Present

**The Minerals, Metals & Materials Society (TMS)** 2018 – Present

**International Association for Dental Research (IADR)** 2018 – Present

**American Association for Dental, Oral, and Craniofacial Research (AADOCR)** 2018 – Present

**Tau Beta Pi Engineering Honor Society** 2017 – Present

**Phi Theta Kappa International Honor Society** 2014 – Present

**Biomedical Engineering Society (BMES)** – President/Co-founder, UNR Student Chapter 2016 – 2018

**Electrochemical Society (ECS)** – Student Member, UNR Student Chapter 2017 – 2018

## PROFESSIONAL DEVELOPMENT & TRAINING

**Biomedical Research Integrity Program** (March 2025) – University of Washington; NIH compliance for responsible conduct of research

**Future Faculty Fellows Workshop Series** (2024-2025) – UW School of Medicine

**NIH-NIDCR Career Development Series** (2023-Present)

**NIH-NIDCR 75th Annual Trainee Symposium** (2024)

**NSF I-Corps** – Market validation for Detect-IV / IV-Safe Swell™

## MENTORING & TEACHING EXPERIENCE

**Graduate and Undergraduate Student Mentorship** (2023-Present) – T90 Postdoctoral Fellow

- Mentoring graduate students through leading research projects and training on synchrotron and characterization instruments
- Training students on X-ray characterization techniques, ML methods, experimental design, and AM-related data analysis workflows
- Served on Master's student committee

**Teaching Assistant** (2018-2023) – University of Washington, Materials Science & Engineering

- Five years of experience as teaching assistant through doctoral studies
- Lecturing for quiz sections, grading assignments and projects
- Holding office hours for students, proctoring exams
- Contributing to overall course progression and development