

José Ignacio Contreras Raggio



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Date of Birth: 03/03/1997 • Chilean | Swiss Residence Permit B (Family reunification)

Data-driven engineer with 7 years of experience in software development, machine learning, and image analysis. Led interdisciplinary research teams and developed automated segmentation and predictive modeling tools. Author and co-author of 10 scientific publications.

Education

Universidad Adolfo Ibáñez (UAI) & Empa/ETH Zürich

Santiago, CL & Dübendorf, CH

PhD Candidate in Complex Systems Engineering

Apr 2022 – Dec 2025 (expected)

Thesis: "Investigating the mechanical and biological properties of seeded 3D-Bioplotting Composite Scaffolds in an in-vitro dynamic bone culture model".

Multidisciplinary research integrating complex systems, bioengineering, and advanced manufacturing; data-driven approach to materials and biomechanics.

Universidad Adolfo Ibáñez (UAI)

Santiago & Viña del Mar, CL

MSc in Bioengineering (GPA: 6.5/7.0)

Mar 2020 – Dec 2022

Thesis: "Fabrication and Characterization of 3D-Bioplotting of Polycaprolactone–Bioactive Glass Composite Scaffolds for Tissue Engineering Applications".

Grade: 7.0/7.0.

Universidad Adolfo Ibáñez (UAI)

Santiago, CL

Professional Degree of Engineering in Bioengineering (GPA: 5.7/7.0)

Mar 2018 – Jul 2021

Thesis: "Design-Fidelity-Structure-Assessment of controlled geometry 3D-bioplotting composite porous scaffolds".

Grade: 6.9/7.0.

Universidad Adolfo Ibáñez (UAI)

Santiago, CL

BSc in Bioengineering (GPA: 5.1/7.0)

Mar 2015 – Dec 2020

Experience

Mechanical Systems Engineering – Empa/ETH Zürich

Dübendorf, CH

PhD Researcher

Jul 2025 – Nov 2025

- **Data Analysis & Automation:** Analyzed 10,000+ microscopy images using automated segmentation pipelines, combining machine learning tools and custom algorithms to extract quantitative biological data efficiently.

PhD Researcher

Jul 2023 – Sept 2024

- **Project Leadership:** Led the development of 10+ bioactive composite formulations, integrating synthesis, 3D printing, and evaluation across mechanical, thermal, chemical, and biological domains.
- **Research Output:** Characterized 200+ scaffold samples and accelerated experimental workflows by 40%, contributing to 2 publications and ongoing collaborative projects.

Master's Internship

Mar 2021 – Nov 2021

- **Process Improvement:** Achieved a 98% printing success rate and improved the dimensional accuracy to within 4% error margin using a custom Python script and process enhancements.
- **Publications:** Submitted 2 peer-reviewed methods papers.

Bachelor Internship (by IAESTE)

Mar 2019 – Dec 2019

- **Protocol Development:** Designed and validated 6+ standardized protocols for chemical, thermal, and mechanical characterization that are still in use by the laboratory.
- **Publications:** Submitted 1 peer-reviewed paper.

Graduate Research Assistant

Mar 2020 – Nov 2025

- **Project Leadership:** Designed and validated a dynamic bioreactor system for in vitro bone tissue engineering, enabling simultaneous perfusion and mechanical stimulation to better replicate physiological conditions.
- **Mentoring:** Guided 8+ Master's students to successful thesis defense through research and academic writing support.

Teaching Assistant

Aug 2016 – Dec 2020

- **Instruction & Assessment:** Assisted 10 courses from introductory to senior level, leading problem-solving sessions, and contributing to exams and assignments across programming, calculus, microeconomics, tissue engineering, biomaterials, and biomechanics.

Undergraduate Research Assistant

Jul 2016 – Feb 2020

- **Fabrication Protocol:** Designed and validated 3 standardized methods for 3D-printed scaffold fabrication and mechanical testing, enabling reproducible workflows.

CloudLab – Sonda & UAI

Santiago, CL

Senior Software Developer

Oct 2016 – Mar 2017

- **Software Development:** Led development of a Laravel–Vue.js customer management dashboard for Sonda employees, used daily by 100+ users to streamline administrative workflows.

Junior Software Developer

Jun 2016 – Sep 2016

- **Performance Recognition:** Advanced to Senior Developer role in 4 months in response to high-quality project delivery, compared to the typical 1.5-year progression timeline.

Projects and Publications

*Shared first authorship.

- [1] **Contreras Raggio, J.I. et al.** In preparation for submission to *Biomaterials Advances*, 2025
From Seashells to Scaffolds: A Comparative Chemical, Mechanical, and Biological Characterization of Natural and Synthetic Calcium Carbonate in 3D-Printed PCL Composites
- Synthesized natural sea-shell–derived bioactive material, compounded composites, and 3D-printed scaffolds.
 - Performed biological evaluations, microscopy imaging, and machine-learning-based cell morphology analysis.
 - Skills: Materials synthesis, DIW 3D printing, cell culture, microscopy, Python (segmentation, morphological descriptors).
- [2] **Contreras Raggio, J.I. et al.** In preparation for submission to *Biomaterials Advances*, 2025
Biocompatibility of Polycaprolactone-Bioglass Composite Scaffolds: Cellular and Molecular Insights for Tissue Engineering
- Led complete fabrication workflow, from material compounding and 3D printing to post-processing.
 - Conducted morphological, chemical, and biological analyses of composite scaffolds.
 - Skills: Composite fabrication, rheology, SEM/EDS, confocal imaging, data interpretation, technical writing.
- [3] Millan, C., Benjumed, I., **Contreras Raggio, J.I. et al.** Submitted: *Materials Today Communications*, 2025
Biocompatibility and Morphological Analysis of Argopecten purpuratus Carbonate Shells for Tissue Engineering Applications with Human Gingival Mesenchymal Stem Cells
- Contributed to manuscript writing and performed microCT and chemical characterization.
 - Skills: MicroCT, data visualization, scientific writing.
- [4] **Contreras Raggio, J.I. et al.** Under review: *MethodsX*, 2025
Methodology to predict 3D printing parameters of custom-made inks based on characterization of ink rheology
- Developed and verified analytical formulas correlating viscosity, shear rate, and print fidelity to minimize trial-and-error testing.
 - Skills: Rheology, experimental design, Python, data modeling, algorithm validation, scientific writing.

- [5] **Contreras Raggio, J.I. et al.** *MethodsX*, 2025
PorMe: A validated open-source image-based pore size and porosity measurement tool for 3D-printed structures
- Developed an automated open-source tool for pore and porosity quantification of 3D-printed scaffolds.
 - Skills: Python, image analysis, algorithm development, scientific writing, open-source software.
- [6] **Contreras Raggio, J.I. et al.** *Polymers*, 2025
Effect of Processing Parameters on the Printability and Mechano-Biological Properties of Polycaprolactone–Bioactive Glass Composites for 3D-Printed Scaffold Fabrication
- Investigated the influence of 3D-printing parameters on scaffold structure and cell response.
 - Synthesis, manufacture, characterization, and analysis of polymer–ceramic scaffolds for bone regeneration.
 - Skills: DIW 3D printing, rheology, SEM, data visualization, scientific writing.
- [7] Dreyer, M.J., Weisse, B., **Contreras Raggio, J.I. et al.** *Journal of Orthopaedic Research*, 2024
The influence of implant design and limb alignment on in vivo wear rates of fixed-bearing and rotating-platform knee implant retrievals
- Supported quantitative analysis of retrieved knee implants and in-vivo wear evaluation.
 - Skills: Retrieval analysis, mechanical testing, data processing.
- [8] **Contreras Raggio, J.I.***, Toro Arancibia, C.*, *et al.* *Polymers*, 2022
Height-to-Diameter Ratio and Porosity Strongly Influence Bulk Compressive Mechanical Properties of 3D-Printed Polymer Scaffolds
- Led design, printing, and testing of 3D-printed polymer scaffolds to analyze mechanical scaling effects.
 - Skills: Mechanical testing, microCT, CAD design, data analysis, teamwork.
- [9] Vallejos Baier, R.*, **Contreras Raggio, J.I.* et al.** *Biomaterials Advances*, 2022
Shape Fidelity, Mechanical and Biological Performance of 3D-Printed Polycaprolactone–Bioactive Glass Composite Scaffolds
- Synthesis, manufacture, characterization, and analysis of polymer–ceramic scaffolds for bone regeneration.
 - Skills: Composite materials, 3D printing, microscopy, statistical analysis.
- [10] Vallejos Baier, R., **Contreras Raggio, J.I. et al.** *Materials Science and Engineering C*, 2021
Structure–Function Assessment of 3D-Printed Porous Scaffolds by a Low-Cost/Open-Source FFF Printer
- Evaluated printing fidelity and mechanical properties using low-cost 3D-printing technologies.
 - Skills: FDM printing, mechanical analysis, open-source tools, reproducible research.
- [11] **Software Development Project** *Internal Project, SONDA-UAI*, 2016
Development of a Web Dashboard for Client Data Management and Decision Support
- Led the development of a full-stack web application integrating Vue.js and Laravel for client data visualization and workflow optimization.
 - Managed a small development team, coordinating feature planning, implementation, and testing.
 - Improved information accessibility and decision-making efficiency for internal and client operations.
 - Skills: Software architecture, full-stack development, project management, leadership.

Skills & Interests

Technical Skills:

- **Characterization:** MicroCT, Optical/Fluorescence Microscopy, SEM/EDS, XRD, FTIR, DSC, TGA, Rheology, Water Contact Angle, Mechanical Testing (ASTM: compression, bending, tensile), Cell Culture, Live/Dead Assays
- **Modeling, Image Analysis & Data Processing:** Digital Volume Correlation (DVC), ImageJ/Fiji, Ilastik, CellProfiler, Mimics, VGStudio, Avizo Fire, Python (NumPy, Pandas, Matplotlib, Open3D), MATLAB, R, Machine Learning (Segmentation, Morphology Analysis), Data Visualization, Process Automation
- **Fabrication & Prototyping:** 3D Printing (DIW, FFF), CAD (SolidWorks, Fusion 360, Autodesk Inventor), Composite Processing, Milling, Material Synthesis, Bioreactors, G-code Generation, Prototyping Workflow Design

Software & Tools:

- **Advanced:** Python, R, Git/GitHub, ImageJ/Fiji, VGStudio, Avizo Fire, Jupyter Notebook, SolidWorks, Excel, PowerPoint, Word
- **Intermediate:** MATLAB, C++, JavaScript, SQL, LaTeX, scikit-learn, TensorFlow, Machine Learning, Autodesk Inventor, ParaView, Mimics, Fusion 360, Arduino
- **Basic:** C#, Docker, REST APIs, AWS, Bash/Linux scripting

Soft Skills: Team-oriented, solution-driven, goal-focused, resilient, adaptable, fast learner, self-motivated, problem-solving mindset, positive attitude, leadership experience

Languages: Spanish (Native), English (C1), German (A2)

Interests: Golf, Padel, Sailing, Wakeboard, Water Ski, Snowboard, Hiking, Cycling, Chess, Volleyball, Bowling, Gaming, Motorbike Riding, Horse Riding

Leadership & Volunteering

IAESTE Switzerland – Committee Member (IT Responsible) 2021 – Present | Zürich, CH

- Volunteer work supporting international trainees; responsible for IT infrastructure and event organization for exchange students

di Raggio CL (Entrepreneurship) – CEO 2021 – 2024 | Santiago, CL

- Managed a family clothing business overseeing marketing, strategy, and financial operations.

LoL UAI – Committee President 2015 – 2018 | Santiago, CL

- Led a student organization, coordinating sponsored events and securing university funding for student activities.

Team Chile (Bowling) – National Youth Team Member 2011 – 2016 | Santiago, CL

- Represented Chile in international bowling tournaments with professional training and national competition experience.

Ankama Games – Community Ambassador 2012 – 2015 | Santiago, CL

- Organized local gaming community events and media coverage as part of official ambassador program.

Scouting – Patrol Leader 2006 – 2010 | Santiago, CL

- Guided and mentored youth members through leadership, teamwork, and outdoor activities.

References

Prof. Dr. Juan F. Vivanco — PhD Supervisor, UAI — juan.vivanco@uai.cl

Prof. Dr. Ameet Aiyangar — PhD Co-Supervisor, Empa & University of Bern — ameet.aiyangar@empa.ch

Mr. Bernhard Weisse — Group Leader, Empa — bernhard.weisse@empa.ch

Dr. Gilberto Siqueira — Co-Supervisor, Empa — gilberto.siqueira@empa.ch

Cell phone numbers of referees can be provided upon request.