ERNESTO CRIADO-HIDALGO
Postdoctoral Scholar Research Associate in Chemical Engineering at **Caltech**
ecriadoh@caltech.edu • (203) 435-8199 • 210 S Catalina Ave Unit 8, Pasadena, CA 91106
Core interests: Mechanobiology, Ultrasound Neuromodulation, Biomolecular Ultrasound, Engineering in Medicine

EDUCATION

University of California, San Diego — La Jolla, CA
Ph.D. Mechanical & Aerospace Engineering with Specialization in Multi-Scale Biology — 2020

University of California, San Diego — La Jolla, CA
Master of Science, Mechanical & Aerospace Engineering — 2014

Polytechnic University of Madrid — Madrid, Spain
BS/MSc program, Aerospace Engineering — 2008

RESEARCH & PROFESSIONAL EXPERIENCE

California Institute of Technology — Pasadena, CA
Divisions of Chemistry and Chemical Engineering & Engineering and Applied Sciences — 2020-present
Postdoctoral Scholar Research Associate in Chemical Engineering & Medical Engineering; Advisor: Mikhail G. Shapiro.
Sonogenetic control of cellular function

University of California, San Diego — La Jolla, CA
Department of Mechanical & Aerospace Engineering — 2013-2020
Graduate Student Researcher (GSR); Advisor: Juan Carlos del Alamo; Co-advisor: Juan C. Lasheras

Focused on collective cell migration of epithelial monolayers in the presence of stiffness and the dynamics of the cerebrospinal fluid (CSF) in the spinal canal:

- Experimentally investigated collective cell migration and intercellular stresses in migrating epithelial monolayers in the presence of heterogeneities.
  Developed novel experimental and computational methodologies to directly measure intercellular forces and characterize the interplay of cells in a highly dynamic developing tissue. These techniques involved microfabrication, cellular transfection, cell sorting, mechanical phenotyping, traction force microscopy, etc.
- Explored the mechanics of the cerebrospinal fluid (CSF) in humans.
  Contributed to address the question of whether a periodic pressure pulsation in the rigid cranial vault could also induce a bulk recirculating flow along the length of the compliant spinal canal and to study the transport and dispersion of intrathecally delivered drugs comparing computational results with phase contrast MRI velocity measurements of the CSF of healthy individuals along the spinal canal.

Yale University — New Haven, CT
Department of Mechanical Engineering — 2011-2013
Visiting Assistant in Research; Advisor: Juan Fernandez de la Mora

Focused on the study of the mass distribution and folding dynamics of large industrial polymers and proteins through the combined technique of ion mobility-mass spectrometry and the study of the necessary activation (solvation) energy for ions to evaporate from charged drops of ionic liquids:

- Investigated large molecules via ion mobility-mass spectrometry (DMA-MS).
  Developed novel experimental techniques to study mono and polydisperse industrial polymers and their surface tension via the study of their metastable transitions taking place in the radio frequency RF field within the ion guide of the MS.
- Studied the kinetics of ion evaporation in ionic liquids via mobility analyzers in tandem (DMA^2).
  Researched the kinetics and solvation energies of numerous ionic liquid nanodrops with applications for colloidal propulsion and atmospheric CO2 capture.

R&D Engineer, SEADM (www.seadm.com) — Valladolid, Spain 2009-2011

- Under the scientific leadership of Juan de la Mora, Professor of Mechanical Engineering at Yale University, and a world expert in the field of electrostatic atomization of liquids from Taylor cones, SEADM develops differential mobility analyzers and ion sources for nanoparticle and vapor analysis and detection.
- Worked on several medical research projects involving breath metabolite analysis via ion mobility and mass spectrometry.

PUBLICATIONS

[23] **Criado-Hidalgo E**, Ngo J, Wu D, Shapiro MG. Spatiotemporal control of gene expression through remote activation of synNotch receptors by acoustic radiation force. *In preparation*.

[22] Lee J, Liu A, **Criado-Hidalgo E**, Ling B, You MY, Jin Z, Shapiro MG. Engineering monocytes as ultrasound reporter cells for cancer detection. *In preparation*.

[21] Shivaei S, Cheung K, Yadav A, Hurvitz I, Lee S, Revilla J, Rabut C, **Criado-Hidalgo E**, Zhang R, Shapiro MG. Ultrasound imaging of in situ transcriptional activity in opaque tissue. Submitted to *Nature Methods*.

[20] Vasallo R, Ling B, **Criado-Hidalgo E**, Robinson N, Schrunk E, Liu A, Daghlian G, Li H R, Swift M B, Mannar D, Malounda D, Lack N, Goldenberg L, Black P C, Cox M E, Salcudean S E, Shapiro M G. A modular method for rapidly prototyping targeted protein nanoparticles using gas vesicles. *Bioconjugate Chemistry*. (In revision)

[19] Tang S, Han H, Ma X, Patel P N, Gong C, Zhang J, **Criado-Hidalgo E**, Yoo J, Li J, Kim G, Wu D, Shapiro MG, Zhou Q, Gao W. Enzymatic microbubble robots. *Nature Nanotechnology*. (In revision).

[18] Liu A[#], Farooq AS[#], Abedi MH, **Criado-Hidalgo E**, Smith CAB, Wu D, Shapiro MG. Thermally controlled state switches for engineered macrophages. *ACS Syn. Bio*. Accepted for publication (2025)

[17] García-de-Herreros A, Yeh Y, Tu Y, Kandasamy A, del Álamo JC, **Criado-Hidalgo E**. Tunable photoinitiated hydrogel microspheres for direct quantification of cell-generated forces in complex three-dimensional environments. *Acta Biomaterialia*. 205 (2025).

[16] Han H, Ma X, Deng W, Zhang J, Tang S, Pak OS, Zhu L, **Criado-Hidalgo E**, Gong C, Karshalev E, Yoo J, You M, Liu A, Wang C, Patel PN, Hays CL, Shen HK, Gunnarson PJ, Wu D, Li L, Zhang Y, Dabiri JO, Wang LV, Shapiro MG, Zhou Q, Greer JR, Gao W. Imaging-guided bioresorbable acoustic hydrogel microrobots. *Sci. Robot.* **9**, eadp3593 (2024).

[15] Hou J, Osman Md, Caplan KA, Ruesch EA, Caban A, **Criado-Hidalgo E**, Ornellas SD, Williams B, Pearce, AA, Dagdeviren, HE, White J, Shapiro MG, Wang F, Ramirez S, Dagdeviren C. An implantable piezoelectric ultrasound stimulator (ImPULS) for deep brain activation. *Nat. Comm*.**15**, 4601 (2024).

[14] Kim W-S, Min S, Kim S K, Kang S, An S, **Criado-Hidalgo E**, Davis H, Bar-Zion A, Malounda D, Kim Y H, Lee J-H, Bae S H, Lee J G, Kwak M, Cho S-W, Shapiro M G, Cheon J. Magneto-acoustic protein nanostructures for non-invasive imaging of tissue mechanics in vivo. *Nat. Mat*. **23**, 290–300 (2024).

[13] Yeh Y, Skinner DE, **Criado-Hidalgo E**, Chen NS, Garcia-de-Herreros A, El-Sakary N, Liu L, Zhang S, Chien S, Lasheras JC, del Álamo JC, Caffrey CR. Biomechanical interactions of Schistosoma Mansoni eggs with vascular endothelial cells facilitate egg extravasation. *PLoS pathogens* 18 (3), e1010309 (2022).

[12] Tilvawala G, Grant A, Wen JH, Wen TH, **Criado-Hidalgo E**, Connacher WJ, Friend JR, Morris TA. Vacuum exhausted isolation locker (VEIL) to reduce inpatient droplet/aerosol transmission during COVID-19 pandemic. *Infection Control & Hospital Epidemiology* (2022), 43, 105–107.

[11] Sincomb S, Coenen W, **Criado-Hidalgo E**, Wei K, King K, Borzage M, Haughton V, Sanchez AL, Lasheras JC. Transmantle Pressure Computed from MR imaging Measurements of Aqueduct Flow and Dimensions. *American Journal of Neuroradiology* 42 (10), 1815-1821 (2021).

[10] Schwartz AB, Campos OA, **Criado-Hidalgo E**, Chien S, del Álamo JC, Lasheras JC, Yeh YT. Elucidating the Biomechanics of Leukocyte Transendothelial Migration by Quantitative Imaging. *Frontiers in Cell and Developmental Biology*. 9 (704), 2021

[9] Coenen W, C, Gutierrez-Montes C, Sincomb S, **Criado-Hidalgo E**, Wei Ke, King K, Haughton V, Martinez-Bazan, Sanchez A L, Lasheras JC. Subject-specific evaluation of CSF bulk flow in the spinal canal: recirculating flow patterns and implications for ITTD drug dispersion. *American Journal of Neuroradiology* 40 (7), 1242-1249 (2019).

[8] Zhang S, Skinner D, Joshi P, **Criado-Hidalgo E**, Yeh Y, Lasheras JC, Caffrey C, del Álamo JC. Quantifying the mechanics of locomotion by the schistosome pathogen to changes in its physical environment. *Journal of The Royal Society Interface*. 16 (150), 20180675 (2018).

[7] Sánchez AL, Martínez-Bazán C, Gutiérrez-Montes C, **Criado-Hidalgo E**, Pawlak G, Bradley W, Haughton V, Lasheras JC. On the bulk motion of the cerebrospinal fluid in the spinal canal. *Journal of Fluid Mechanics 841* (2018): 203-227

[6] Martínez-Lozano P, **Criado-Hidalgo E**, Vidal E, Cristoni S, Franzoso F, Piatti M, Brambilla P. Differential mobility analysis-mass spectrometry coupled to XCMS algorithm as a novel analytical platform for metabolic profiling. *Metabolomics* 9, no. 1 (2013): 30-43.

[5] Criado-Hidalgo E, Fernandez-Garcia J, Fernandez de la Mora, J. Mass and charge distribution analysis in negative electrosprays of large polyethylene glycol chains by ion mobility mass spectrometry. *Analytical chemistry* 85 (5), 2710-2716. 2013.

[4] Roibás E, Tierno SP, **Criado-Hidalgo E**, Doménech-Garret JM, Donoso JM, Conde L. Characterization of the Ion Beam Neutralization of Plasma Thrusters Using Collecting and Emissive Langmuir Probes. *Contributions to Plasma Physics* 53 (1), 57-62. 2013.

[3] Martinez Lozano Sinues P, **Criado-Hidalgo E**, Vidal-de-Miguel G. Mechanistic study on the ionization of trace gases by an electrospray plume. *International Journal of Mass Spectrometry* 313, 21-29 (2012).

[2] Criado-Hidalgo E, Roibás E, Tierno SP, Rodríguez De Francisco P, Domenech-Garret JL, Donoso JM, Conde L. Ion beam neutralization and properties of plasmas from low power ring cusp ion thrusters. *Physics of Plasmas* 19 (2), 023505 (2012).

[1] Troll O, Conde L, **Criado-Hidalgo E**, Donoso JM, Herdrich G. Measurements of plasma properties using fast sweep Langmuir probes in unmagnetized weakly ionized plasmas. *Contribution to Plasma Physics* 50 (9), 819-823. (2010)

[#] Equal contribution

PATENT APPLICATIONS

[1] Borrajo-Pelaez R, **Criado-Hidalgo E**, Vidal-de-Miguel G. Method and apparatus for monitoring stress levels or sudden changes of humor in humans or other individuals in real time by means of vapor analysis. US Patent App. 13/161,662 (2011)

CONFERENCE PRESENTATIONS & CONTRIBUTIONS

2023 Synthetic Biology: Engineering, Evolution & Design (SEED). Los Angeles, CA. **May 2023**
Shivaei S, Rabut C, Hurvitz I, **Criado-Hidalgo E**, Cheung KYM, Zhang R J, Shapiro M G. "Ultrasound Imaging of in Situ Gene Expression in the Brain"

International Symposium on Biomolecular Ultrasound & Sonogenetics (ISBUS). Caltech. Pasadena, CA. **Dec 2022**
Shen H, **Criado-Hidalgo E**, Yoo S, Wu Di, Shapiro M G. "Systematic Characterization of Sonogenetic Membrane Proteins in an *in vivo*-Mimicking Environment"

Tianqiao and Chrissy Chen Institute for Neuroscience Annual Retreat. Caltech. Pasadena, CA. **May 2022**
Jin Z, Shivaei S, **Criado-Hidalgo E**, Rabut C, Yoo S, Lakshmanan A, Tran T, Zhang R, Abedi M, Zhang R, Ling B, Duan M, Hurt RC, Dutka P, Malounda D, Shapiro MG. "Toward noninvasive imaging of neural activity with acoustic reporter genes"

Biophysical Society (BPS) Annual Meeting, San Francisco, CA **Feb 2022**
Criado-Hidalgo E, Garcia-Herreros A, Yeh Y, Lasheras J, del Alamo JC. "Fabricating biocompatible polyacrylamide microbeads for cell-generated mechanical force quantification via photoinitiated polymerization."

World Molecular Imaging Congress (WMIC), Miami, FL **Oct 2021**
Shivaei S, Rabut C, Abedi M, **Criado-Hidalgo E**, Zhang R, Dutka P, Duan M, Shapiro M G. "Viral Encoding of Acoustic Reporter Genes for in situ Imaging of Mammalian Gene Expression."

Biophysical Society (BPS) Annual Meeting, San Diego, CA **Feb 2020**
Criado-Hidalgo E, Garcia-Herreros A, Yeh Y, Lasheras J, del Alamo JC. "A Capillary Controlled Hydrogel Microchannel for Isotropic Compressive Stress Quantification."

Biophysical Society (BPS) Annual Meeting, San Diego, CA **Feb 2020**
Yeh Y, Serrano R, **Criado-Hidalgo E**, del Alamo JC, Lasheras J. "Biomechanics of JAM-C-Mediated Neutrophil Reverse Transendothelial Migration."

Biophysical Society (BPS) Annual Meeting, San Diego, CA **Feb 2020**
Sincomb S, Haughton V, Sanchez A, **Criado-Hidalgo E**, Lasheras J. "Strain accumulation visco-elastic ventriculomegaly hypothesis for the onset of idiopathic Normal Pressure Hydrocephalus (iNPH)."

American Physical Society (APS) Annual Meeting – Division of Fluid Dynamics, Seattle, WA **Nov 2019**
Sincomb S, Haughton V, Sanchez A, **Criado-Hidalgo E**, Lasheras J. "Strain accumulation visco-elastic ventriculomegaly hypothesis for the onset of idiopathic Normal Pressure Hydrocephalus (iNPH)."

American Society for Cell Biology (ASCB) | European Molecular Biology Organization (EMBO) Annual Meeting, San Diego, CA **Dec 2018**
Criado-Hidalgo E, Yeh Y, Lasheras J, del Alamo JC. "Experimental and computational methodologies to measure intercellular forces during tissue development."

Southern California Fluid Mechanics Annual Meeting (SoCal), San Diego, CA **April 2017**
Criado-Hidalgo E, Sanchez A, Martinez-Bazan C, Bradley W, Haughton W, Lasheras J. "The circulation of the cerebrospinal fluid (CSF) in the spinal canal"

Biophysical Society (BPS) Annual Meeting, Los Angeles, CA **Feb 2017**
Criado-Hidalgo E, Yeh Y, Serrano R, del Alamo JC, Lasheras J. "Experimental and computational methodologies to measure intercellular forces during tissue development."

American Society for Cell Biology (ASCB) Annual Meeting, San Diego, CA **Dec 2016**
Criado-Hidalgo E, Serrano R, Yeh Y, del Alamo JC, Lasheras J. "Experimental and computational methodologies to measure intercellular forces during tissue development."

Biophysical Society (BPS) Annual Meeting, Los Angeles, CA **Feb 2016**
Criado-Hidalgo E, Serrano R, Garcia-Diez M, Yeh Y, Rodriguez-Rodriguez J, del Alamo JC, Lasheras J . "Experimental and computational methodologies to measure intercellular forces during tissue development."

American Society for Cell Biology (ASCB) Annual Meeting, San Diego, CA **Dec 2015**
Criado-Hidalgo E, Garcia-Diez M, Yeh Y, Rodriguez-Rodriguez J, del Alamo JC, Lasheras J . "Experimental and computational methodologies to measure intercellular forces during tissue development."

American Society of Mass Spectrometry (ASMS) Annual Meeting, Minneapolis, MN **June 2013**
Criado-Hidalgo E, Vidal-de-Miguel G, Borrajo-Pelaez R. "On-line detection of human stress by real time mass spectrometric monitoring of skin volatiles"

American Society of Clinical Oncology (ASCO) Annual Meeting, Chicago, IL **June 2012**
Zambrana-Tevar F, Herrero A, Vidal-de-Miguel G, Bailador G, **Criado-Hidalgo E**, Marquina I, Sanchez-Avila C, Sereno M, Gomez-Raposo C, Lopez-Gomez M, Merino M, Aguayo C, Alvarez-Gallego M, Erdozain JC, Comas C, Mancenido N, Feliu J, Garcia D, Casado E. "On-line breath analysis of volatile organic compounds as a method for colorectal cancer detection"

American Society of Mass Spectrometry (ASMS) Annual Meeting, Vancouver, BC **May 2012**
Criado-Hidalgo E, Fernandez-Garcia J, Fernandez de la Mora J. "Low charge state of electrosprayed polystyrene and other polymer ions, and their analysis by ion mobility-mass spectrometry (IMS-MS)"

HONORS, FELLOWSHIPS AND AWARDS

James Boswell Postdoctoral Fellowship at California Institute of Technology July 2020

- **2-year postdoctoral fellowship** to conduct multidisciplinary research centered on interfacing engineering and medicine.

"Interfaces" Training Grant Student Seminar poster award winner Feb 2018

- **Criado-Hidalgo E**, Sanchez A, Martinez-Bazan C, Bradley W, Haughton W, Lasheras J. "The circulation of the cerebrospinal fluid (CSF) in the spinal canal"
- Selected as the winner of the Poster Presentation competition at the Interfaces External Advisory Meeting.

Gordon Scholar 2015-2016 cohort June 2015

- Accepted at the Bernard and Sophia Gordon Engineering Leadership Center Scholars Program at the Jacobs School of Engineering.
- The program offers awarded students "resources to develop their recognized leadership ability, broaden their perspective across a spectrum of engineering topics, and make valuable contacts with current professional engineering leaders as well as other like-minded peers and alumni of the Gordon Center".

UC San Diego's Interdisciplinary Ph.D. Specialization in Multi-Scale Biology ("Interfaces") Sept 2014

- Recognized by the Steering Committee and accepted in a program that provides unique interdisciplinary graduate training at the interfaces between the biological, health, physical and engineering sciences. The training program has been made possible with the support of grants from **the Howard Hughes Medical Institute (HHMI)** and **the National Institute for Biomedical Imaging and Bioengineering (NIBIB)** at NIH.

"la Caixa" Fellowship for graduate studies in the US June 2012

- Awarded a full **2-year fellowship to pursue graduate studies in the US**.
- grant # LCF/BQ/US12/10110011
- "la Caixa" Foundation grants 45 full tuition and stipend 2-year fellowships each year to Spanish citizens to carry out postgraduate studies at universities in North America (United States and Canada) and at universities in the Asia-Pacific zone (Australia, South Korea, India, Japan, Singapore and China) for all disciplines.
- Less than 5% students from a pool of highly competitive applicants are awarded.

Pegasus AIAA European Student Conference MSc Thesis Competition (3rd place) Feb 2009

- Awarded to the MSc thesis "Design of a ring-cusp ion thruster as a laboratory plasma source"
- First ever Spanish student to be awarded in this European competition.

"Foindesa" award to the best MSc Thesis in the Aerospace field Nov 2008

- Award by the Spanish Foundation for the Research and Development in the Aerospace field to the best MSc thesis in aerospace engineering at the Polytechnic University of Madrid (Spain).

TEACHING EXPERIENCE

University of Notre Dame Notre Dame, IN
Aerospace and Mechanical Engineering Graduate Program (AME)
Guest lecture AME 40572/60572: Introduction to Biomechanics. Topic: "The circulation of the cerebrospinal fluid (CSF) in the spinal canal" Fall 2020

University of California, San Diego La Jolla, CA
Bioengineering Graduate Program
Teaching Assistant, Molecular Imaging (BENG235) Spring 2018

University of California, San Diego La Jolla, CA
Mechanical & Aerospace Engineering Graduate Program (MAE)
Teaching Assistant, Numerical Methods for Simulation, Optimization and Control (MAE290A) Fall 2017

EDITORIAL CONTRIBUTIONS

Peer Review for (Journals): *PLOS One*, *Journal of the American Society for Mass Spectrometry (JASMS)*, *Scientific Reports*, *Frontiers in Bioengineering and Biotechnology*.

Reviewer for (Conferences): *World Molecular Imaging Congress 2023*, *World Molecular Imaging Congress 2024.*

OUTREACH AND MENTORING

Mentor at "la Caixa" Fellowship for graduate studies in the US Fall 2024

- Mentored a prospective PhD student from Spain and helped them successfully navigate the process of graduate school admissions in the US.

Reviewer for the 2024 Graduate Women in Science Fellowship Summer 2024

- Served as an invited reviewer for the Fellowship call.

Summer Undergraduate Research Fellowships (SURF) program proposals reviewer Summer 2024

- SURF students have the opportunity to conduct research under the guidance of experienced mentors working at the frontier of their fields. The program lasts typically 10 weeks, but students often repeat in the same lab every summer resulting in a long-lasting mentorship experience.

Summer Undergraduate Research Fellowships (SURF) program mentor Summer 2022

- Mentored one sophomore undergraduate student from Caltech (BSc in Computation & Neural Systems) to develop a "MATLAB-based systemic detection and analysis of spatiotemporal neuronal activity patterns"

Diversity Equity and Inclusion (DEI) coordinator for the Shapiro Group. CCE Division. Caltech 2021-2022

- In an effort to promote diversity, equity and inclusion (DEI) in individual research groups, CCE adopted in 2021 a new group role, the DEI Coordinator with the mission of helping foster a healthy, diversity-oriented space within their research group and to discuss and encourage participation in DEI-related ideas and initiatives
- Each DEI Coordinator is trained by the Caltech Center for Inclusion and Diversity (CCID) and attends regular meetings with the appointed CCE Diversity Officer to discuss the DEI climate on campus and to propose actionable items and/or relay feedback to promote DEI in their groups

Presenter, Johns Hopkins Center for Talented Youth (CTY) 2014-2020

- Participated in CTY Science and Technology Series and assisted in hosting academic programs for youth and parents coming to UC San Diego from all over the United States.
- Delivered 6-hour hands-on workshops featuring qualitative experiments. Prepared petri dishes with the slime mold *Physarum Polycephalum* and taught participants use educational microscopes to observe amoeboid migration.
- Gave multiple presentations during the workshop to excite students about flow physics and pursuing engineering careers.

Bioengineering (BE) Senior Design Final Project 2017-2018

- Mentored three senior BE undergraduate students to develop the project "Microscopy Stage Bioreactor and Gas Mixer" consisting of the full design, manufacture and testing of a fully functional bioreactor, compatible with standard inverted microscopes, for long term cell culture applications and simultaneous metabolic profiling.

Graduate Mentor, Jacobs Undergraduate Mentoring Program (JUMP). IDEA Center at UC San Diego 2016-2017

- Mentored a group of first and second year undergraduate engineering students through the academic year.
- The IDEA Center offers several mentorship programs, with involvement from undergraduates, transfer students, and graduate students. Through these programs, students are able to engage with the UC San Diego campus community, expand their peer and professional network, and learn more about university life at the undergraduate and graduate levels.

Ivy Spain, Board member and graduate mentor. 2013-2016

- As a non-profit organization we aimed to encourage and support young Spanish students in their aspirations to enroll in North American top institutions (US and Canada).
- Co-organized two annual symposiums that brought together Spanish leaders in the US (such as Dr. Valentin Fuster, Iñaki Berenguer and Jose Maria Carrascal), young professionals, students and postdoctoral scholars.
- Mentored several recently graduated engineering students and guided them through the process of applying to graduate schools in the United States.

SKILLS

Experimental: Design of experiments (DOE), Traction Force Microscopy (TFM), Confocal Microscopy, Ultrasound Imaging, MR Imaging, Atomic Force Microscopy, Microfluidics, Photolithography, Microfabrication, DRI Etching, Prototyping, Mammalian Cell Culture, Molecular Cloning, Viral Packaging, Cellular Transfection, Cell Sorting, Mass Spectrometry, Ion Mobility, Ion Sources. **Analysis and Computation:** Image Processing, Data Analysis & Visualization, Computational Modeling, Statistical Analysis, Matlab, Python, CAD. **Soft skills:** Leadership, Effective communication skills, Dependability, Teamwork, Flexibility, Creativity, Problem-solving, Integrity.