Santiago Correa

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Education

Massachusetts Institute of Technology, Cambridge, MA
Ph.D. in Biological Engineering (Sept. 2012-Aug. 2018)
Thesis: *Engineering layer-by-layer nanoparticles for the targeted delivery of therapeutics to ovarian cancer*
Advisor: Dr. Paula T. Hammond; Co-Advisor: Dr. Dane K. Wittrup;
Committee: Dr. Darrell J. Irvine & Dr. Sangeeta N. Bhatia

Yale University, New Haven, CT
Bachelor of Science, Biomedical Engineering (Aug. 2008-May 2012)
Distinction in Biomedical Engineering, Molecular Engineering Track
Research Advisor: Themis Kyriakides

Research Experience

Appel Lab (Oct. 2018-Present)
Stanford University, Dept. of Materials Science & Engineering

Lab Focus: Development of tunable biomimetic materials for applications in drug delivery, regenerative medicine, immuno-engineering, and environmental engineering.

- Leading the lab's focus on hydrogel delivery of antibodies for cancer immunotherapy.
- Determining the ability for local immunotherapy to generate systemic anticancer immunity.
- Reducing toxicity of clinically relevant immunotherapies through local delivery via hydrogels.
- Developing lipid nanotechnology-based hydrogels capable of precise sequential delivery of diverse cargo following a single administration.

Hammond Lab (Feb. 2013-Aug. 2018)
Massachusetts Institute of Technology, Dept. of Chemical Engineering

Lab Focus: Development of multifunctional, hierarchical nanomaterials using the layer-by-layer assembly approach to solve biomedical problems in cancer and tissue regeneration.

- Developed a new method to prepare layer-by-layer nanoparticles using tangential flow filtration that increased synthetic yield 20-fold.
- Elucidated synthetic conditions governing layer-by-layer nanoparticle self-assembly, which led to 8-fold increased siRNA loading and improved *in vivo* gene silencing.
- Identified surface chemistries that mediated novel subcellular localization in ovarian cancer cells, including prolonged membrane binding, caveolae-targeting, and endolysosomal-targeting.
- Introduced diagnostic functionality to siRNA-loaded nanoparticles in order to simultaneously detect and treat metastatic diseases, including late-stage ovarian, liver, and pancreatic cancer.

FELLOWSHIPS & AWARDS

Princeton University & University of Delaware: *Soft Matter for All Early Career Speaker*	2021
Biomedical Engineering Society: *UNITE Featured Speaker*	2021
American Chemical Society: *POLY/PMSE Future Faculty Scholar*	2021
Columbia University: *Rising Stars in Engineering in Health*	2020
National Cancer Institute: *Ruth L. Kirschstein F32 NRSA Postdoctoral Fellowship*	2019
Siebel Foundation: *Siebel Scholar*	2018
Alfred P. Sloan Foundation: *Sloan University Centers for Exemplary Mentoring Scholar*	2016
National Science Foundation: *Graduate Research Fellowship*	2012
MIT: *Lemelson Engineering Presidential Fellowship*	2012
MIT: *Dean's Diversity Fellowship*	2012

SELECTED PRE-PRINTS

- **Correa S†,** Grosskopf AK†, Klich JH, Hernandez HL, Appel EA. *Injectable Liposome Based Supramolecular Hydrogels for the Programmable Release of Multiple Protein Drugs.* bioRxiv. 2021 September 26. doi.org/10.1101/2021.09.26.461871
- **Correa S,** Gale EC, Mayer AT, Xiao Z, Liong C, Klich JH, Brown RA, Meany E, Saouaf O, Maikawa CL, Grosskopf AK, Mann JL, Idoyaga J, Appel EA. *Injectable Nanoparticle-Based Hydrogels Enable the Safe and Effective Deployment of Immunostimulatory CD40 Agonist Antibodies.* bioRxiv. 2021 June 28. doi.org/10.1101/2021.06.27.449987
- Seo J-W, Fu K, **Correa S,** Eisenstein M, Appel EA, Soh HT. *Real-time monitoring of drug pharmacokinetics within tumor tissue in live animals.* bioRxiv. 2021 July 3. doi.org/10.1101/2021.07.03.451023

FIRST AND CO-FIRST AUTHORED PUBLICATIONS

1. **Correa S**, Grosskopf A, Lopez Hernandez H, Chan D, Yu A, Stapleton L, Appel EA. *Translational Applications of Hydrogels.* Chemical Reviews. 2021; Article ASAP. doi: 10.1021/acs.chemrev.0c01177
2. **Correa S**, Boehnke N, Barberio AE, Deiss-Yehiely E, Shi A, Oberlton B, Smith SG, Zervantonakis I, Dreaden EC, Hammond PT. *Tuning Nanoparticle Interactions with Ovarian Cancer through Layer-by-Layer Modification of Surface Chemistry.* ACS Nano. 2020; 14(2):2224-37. doi: 10.1021/acsnano.9b09213
3. Boehnke N†, **Correa S†**, Hao L†, Wang W, Straehla JP, Bhatia SN, Hammond PT. *Theranostic Layer-by-Layer Nanoparticles for Simultaneous Tumor Detection and Gene Silencing*. Angewandte Chemie. 2020; 59, 2776. doi: 10.1002/anie.201911762
4. **Correa S†**, Boehnke N†, Deiss-Yehiely E, Hammond PT. *Solution Conditions Tune and Optimize Loading of Therapeutic Polyelectrolytes into Layer-by-Layer Functionalized Liposomes.* ACS Nano. 2019;13(5):5623-5634. doi: 10.1021/acsnano.9b00792
5. **Correa S†**, Dreaden EC†, Gu L, Hammond PT. *Engineering Nanolayered Particles for Modular Drug Delivery.* Journal of Controlled Release. 2016;240:364-386. doi: 10.1016/j.jconrel.2016.01.040
6. **Correa S**, Choi KY, Dreaden EC, Renggli K, Shi A, Gu L, Shopsowitz KE, Quadir MA, Ben-Akiva E, Hammond PT. *Highly Scalable, Closed-Loop Synthesis of Drug-Loaded, Layer-by-Layer Nanoparticles.* Advanced Functional Materials. 2016;26(7):991-1003. doi: 10.1002/adfm.201504385

† Indicates co-first authors

SELECTED CO-AUTHORED PUBLICATIONS (OUT OF 14)

- Grosskopf AK, Correa S, Baillet J, Maikawa CL, Gale EC, Brown RA, Appel EA. *Consistent Tumorigenesis with Self-Assembled Hydrogels Enables High-powered Murine Cancer Studies.* Communications Biology. (*In press*). bioRxiv. 2021 June 7. doi.org/10.1101/2021.04.13.439705
- Meis CM, Grosskopf AK, Correa S, Appel EA. *Injectable Supramolecular Polymer-Nanoparticle Hydrogels for Cell and Drug Delivery Applications.* Journal of Visualized Experiments. 2021 Feb 7;168:e62234.
- Silva AS, Shopsowitz KE, Correa S, Morton SW, Dreaden EC, Casimiro T, Aguiar-Ricardo A, Hammond PT. *Rational Design of Multistage Drug Delivery Vehicles for Pulmonary RNA Interference Therapy.* International Journal of Pharmaceutics. 2020 Oct 26:119989.
- Smith AA, Gale EC, Roth GA, Maikawa CL, Correa S, Yu AC, Appel EA. *Nanoparticles Presenting Potent TLR7/8 Agonists Enhance Anti-PD-L1 Immunotherapy in Cancer Treatment.* Biomacromolecules. 2020 Aug 20;21(9):3704-12.
- Barberio AE, Smith SG, Correa S, Nguyen C, Nhan B, Melo M, Tokatlian T, Suh H, Irvine DJ, Hammond PT. *Cancer Cell Coating Nanoparticles for Optimal Tumor-Specific Cytokine Delivery.* ACS Nano. 2020 Jul 21;14(9):11238-53.
- Mann JL, Maikawa CL, Smith AA, Grosskopf AK, Baker SW, Roth GA, Meis CM, Gale EC, Liong CS, Correa S, Chan D. *An Ultrafast Insulin Formulation Enabled by High-Throughput Screening of Engineered Polymeric Excipients.* Science Translational Medicine. 2020 Jul 1;12(550).
- Maikawa CL, Smith AA, Zou L, Roth GA, Gale EC, Stapleton LM, Baker SW, Mann JL, Anthony CY, Correa S, Grosskopf AK. *A Co-Formulation of Supramolecularly Stabilized Insulin and Pramlintide Enhances Mealtime Glucagon Suppression in Diabetic Pigs.* Nature Biomedical Engineering. 2020 May 11:1-1.
- Choi KY, Correa S, Min J, Li J, Roy S, Laccetti KH, Dreaden E, Kong S, Heo R, Roh YH, Lawson EC, Palmer PA, Hammond PT. *Binary Targeting of siRNA to Hematologic Cancer Cells In Vivo using Layer-by-Layer Nanoparticles.* Advanced Functional Materials. 2019;29(20).
- Dreaden EC, Kong YW, Quadir MA, Correa S, Suárez-López L, Barberio AE, Hwang MK, Shi AC, Oberlton B, Gallagher PN, Shopsowitz KE, Elias KM, Yaffe MB, Hammond PT. *RNA-Peptide Nanoplexes Drug DNA Damage Pathways in High-Grade Serous Ovarian Tumors.* Bioengineering & Translational Medicine. 2018;3(1):26-36.
- Dang X, Gu L, Qi J, Correa S, Zhang G, Belcher AM, Hammond PT. *Layer-by-Layer Assembled Fluorescent Probes in the Second Near-Infrared Window for Systemic Delivery and Detection of Ovarian Cancer.* Proceedings of the National Academy of Sciences. 2016;113(19):5179-84.
- Dreaden EC, Kong YW, Morton SW, Correa S, Choi KY, Shopsowitz KE, Renggli K, Drapkin R, Yaffe MB, Hammond PT. *Tumor-Targeted Synergistic Blockade of MAPK and PI3K from a Layer-by-Layer Nanoparticle.* Clinical Cancer Research. 2015;21(19):4410-9.

SELECTED PRESENTATIONS & SEMINARS

- **Correa S.** *Self-Assembling Nanotechnologies for Precision Immuno-Engineering.* Oral presentation at the **Biomedical Engineering Society's UNITE Future Faculty Webinar.** 2021. Virtual. (Award talk)
- **Correa S.** *Self-Assembling Nanotechnologies for Precision Biomaterials.* Oral presentation at **Northwestern University's Department of Materials Science & Engineering**. 2021. Virtual. (Invited talk)
- **Correa S.** *Local immunostimulation with injectable hydrogels provides safer and more effective cancer immunotherapy.* Oral platform talk at the inaugural **LatinX in BME Symposium.** Virtual.
- **Correa S.** *Locoregional Immunostimulation with Injectable Hydrogels Provides Safer and More Effective Cancer Immunotherapy.* Oral presentation at the **Columbia University School of Engineering Rising Stars in Engineering in Health.** 2020. Virtual. (Award talk)

SELECTED PRESENTATIONS & SEMINARS (CONTINUED)

- **Correa S.** *Immunomodulatory Hydrogels for Safe and Effective Cancer Immunotherapy.* Oral presentation at the **University of Minnesota's Department of Biomedical Engineering Seminar Series.** 2020. Virtual. (Invited talk)
- **Correa S**, Gale EC, Mayer AT, Xiao Z, Mann JL, Appel EA. *CD40 Agonists Delivered via Injectable Hydrogel Reservoirs Safely Stimulate Anticancer Immune Response.* Oral presentation at the **World Biomaterials Congress.** 2020. Virtual.
- **Correa S**, Gale EC, Mayer AT, Xiao Z, Mann JL, Appel EA. *Injectable Hydrogel Reservoirs Alter CD40 Agonist Antibody Pharmacokinetics to Improve Safety and Efficacy.* Oral presentation at the **Materials Research Society Fall Meeting.** 2020. Virtual.
- **Correa S**, Gale EC, Mayer AT, Xiao Z, Mann JL, Appel EA. *Injectable Hydrogel Reservoirs Alter CD40 Agonist Antibody Pharmacokinetics to Improve Safety and Efficacy.* Poster at the **Keystone eSymposia: Advances in Cancer Immunotherapy.** 2020. Virtual.
- **Correa S**, Boehnke N, Barberio A, Quadir MA, Dreaden EC, Hammond PT. *Drug Delivery for Ovarian Cancer: The Role of Surface Chemistry and Administration Route for Targeting Therapeutics with Layer-by-Layer Nanoparticles.* Oral presentation at 256th **American Chemical Society National Meeting & Exposition.** 2018; Boston, MA.

PATENTS

- Correa S, Grosskopf AK, Klich JH, Appel EA (2021). *Injectable Polymer Liposome Hydrogel.* U.S. Patent Application No. 63/177373.
- Grosskopf AK, Appel EA, Correa S (2020). *Materials for Tumor Inoculation in Murine Mouse Models and Uses Thereof.* U.S. Patent Application No. 63/094716.
- Barberio AE, Correa S, Melo MB, Tokatlian T, Dreaden EC, Hammond PT, Irvine DJ (2019). *Layer-by-Layer Nanoparticles for Cytokine Therapy in Cancer Treatment.* U.S. Patent Application No. 16/175,311.
- Appel EA, Agmon G, Gale E, Correa S, Davis, MM (2019). *Injectable Hydrogels for Controlled Release of Immunomodulatory Compounds.* International Patent Cooperation Treaty Application No. PCT/US2019/054070.

LEADERSHIP & SERVICE

LatinXinBME Professional Development Chair (Sept. 2021-Present)

- Designing professional development content for LatinX biomedical engineers focusing on time management, writing habits, visual communication, and project management.

Stanford Diversity Perspectives Seminar Series Planning Team (April 2019-Present)

- Part of a 5-member team raising funds and organizing a seminar series to bring a trainee-nominated speaker to share their research and their experience with diversity and inclusion in academia.
- Adapted the event to a virtual format that expands accessibility to more students.
- Developing a collection of digital resources for undergraduates interested in pursuing research.

Gordon Research Seminar Co-Chair, Drug Carriers in Medicine & Biology (Sept. 2014-Aug. 2016)

- Organized a forum for early-career researchers to present and exchange ideas pertaining to the field of nanoparticle drug delivery.
- Developed an agenda focused on: challenges in scalable fabrication of nanoparticles; the nano-bio interface between drug carriers and cells; establishing more critical evaluation of in vivo drug delivery efficacy; and advances in understanding the immune system's role in nanomedicine.
- Raised over $10,000 in funds from the biomedical industry, scientific publications, and universities to cover the seminar budget and to subsidize invited speaker expenses.

LEADERSHIP & SERVICE (CONTINUED)

Lab Representative, Marble Center for Cancer Nanomedicine (June 2016-Aug. 2018)

- Coordinated the Hammond Lab's role in a collaborative center at MIT that brings interdisciplinary teams together to overcome challenges in cancer detection and treatment. This involved connecting lab members with potential collaborators to take advantage of Marble funding mechanisms.
- Designed and moderated "hot-topic" discussions addressing major challenges in nanomedicine.

Hammond Lab Leadership Roles

- *Head of lab manager search committee*; hired the lab's first full-time lab manager. (Aug. 2015-2016)
- *Head of mamalian tissue culture room*; managed training & $36,000/yr budget. (Feb. 2015-May 2016)
- *Environmental Health & Safety representative*; provided lab-specific training, ensured researchers were in compliance with lab safety rules and state & federal regulations. (Sept. 2013-Sept. 2014)

TEACHING & OUTREACH

Design of a Virtual Research Internship, Stanford (Summer 2020)

- Developed an 8-week virtual program for First-Generation Research Interns during the pandemic.
- Designed and led a weekly immuno-engineering workshop that provided a crash course in immuno-biology, cancer biology, immuno-oncology, biomaterials, how materials interface with the body and the immune system, adoptive cell therapies, and immuno-modulatory materials.
- Incorporated online programming from the National Center for Faculty Development & Diversity to help students develop a daily writing habit and time management skills.
- Organized one-on-one meetings and panels with grad students and postdocs to expose interns to what life in academia is like and to demystifiy the process of applying for and completing a PhD.
- Guided students as they developed and presented a pitch for a novel research project based on work in the Appel Lab.

Guest lecturer

MATSCI 385/BIOE385: Biomaterials for Drug Delivery, Stanford (Fall 2019; Winter 2021)

- Planned and taught the "Engineering immunity with nanomaterials" lecture for undergrad and graduate students, discussing the interdisciplinary interface of materials science and immunology.

"At The Frontiers" Seminar Series, The Innovation Institute, Boston (May 2016)

- Planned and taught a seminar of the fundamentals of nanomedicine to local middle school students.

Teaching assistant *Course 20.380 Biological Engineering Design*, MIT (Spring 2014)

- Worked one-on-one with seniors developing their capstone projects with a focus on improving their verbal, written, and visual communication skills.
- Restructured the class to have greater emphasis on periodic feedback to students.
- Launched a new departmental award to motivate students during their final semester. Organized a panel of 15 judges from industry and academia to evaluate proposed projects and select a winner.

MENTORSHIP

Alejandro Salazar, **UCLA undergraduate**; Emerson Collective First Gen Internship (Summer 2020, virtual)
Aria Shi, **MIT undergraduate**; Undergraduate Research Opportunity Program (UROP) (2014-18)
Mariam Ahmed, **UCSD undergraduate**; MIT Summer Research Program (MSRP) (Summer 2017)
Benjamin Oberlton, **MIT undergraduate**; UROP (2016-17)
Esperanza Hernandez, **University of Utah undergraduate**; MSRP (Summer 2016)
Elana Ben-Akiva, **MIT undergraduate**; UROP (2014-15)