

Helena de Puig Guixé, Ph.D.
Postdoctoral Fellow

Wyss Institute for Biologically Inspired Engineering
Harvard Medical School, Harvard University
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Boston, 02115 MA

EDUCATION

Postdoctoral research in the Wyss Institute at Harvard. Collins lab	current
Ph.D. in MIT Department of Mechanical Engineering. Gehrke Lab	2017
M.S. MIT Department of Mechanical Engineering. Hamad-Schifferli Lab	2013
Institut Quimic de Sarria (IQS), Universitat Ramon Llull, Spain	2011
Industrial Engineer	

FELLOWSHIPS AND AWARDS

> \$350,000 awarded in prestigious fellowships in Spain and MIT

CFAR – Early Stage Principal Investigator, \$60,000	2020-current
Broshy Fellowship, awarded to two MIT students, \$25,000	2016-2017
MIT-TATA Fellowship, 26 awardees, tuition and stipend (~\$100,000)	2016-2017
Rafael del Pino Fellowship, 12 awardees, €50,000	2014-2016
La Caixa Fellowship, 40 awardees, tuition and stipend (~\$160,000)	2011- 2013
MIT GSC conference travel grant	2013 and 2016
Pare Salvador Gil Award from IQS for research excellence	2012
European Materials Research Society, Bionano@Nice travel award	2011
MOBINT fellowship from the Catalan Government	2010

TEACHING EXPERIENCE

Teaching Assistant at MIT

Cambridge, MA 2016

Teaching assistant in the class “HST.426: HST Maker lab: Construction sets for health”. It is a class and laboratory-based course consisting on the development of new medical devices and construction kits that would allow patients or physicians to personalize medical treatment and diagnostic options. Also, the class led to the development of new sensing methods and diagnostics in medical devices for home and global health.

Tools: Modeling in 2D and 3D, 3D printing, laser cutting, image analysis, Arduino programming and sensing, kit design

Instructors: Lee Gehrke, José Gómez-Márquez, Anna Young, **TA:** Helena de Puig.

Mentorship experience

Mentor of two visiting M.S. students:

2015-2016- M. Carré
2016-2017- D. Fandos

Mentor of four undergraduate UROP students

2011-2012- H. D’Couto
2011-2012- D. Flemister
2015-2017- A. Reddy
2018-2020- M. Kline

EXPERIENCE AND EMPLOYMENT HISTORY

Postdoctoral Research at Harvard University Boston, MA 2017 - current
Principal Investigator position focused on HIV molecular diagnostics started May 2020.

Expertise in assay development for both CRISPR-Cas-based diagnostics (SHERLOCK and DETECTR) as well as synthetic biology-based diagnostics (toehold switches and INSPECTR technology). Expertise in nucleic acid amplification tools (qPCR, PCR, LAMP, RPA, other). Current team leader in diagnostic efforts to manufacture devices for the detection of SARS-CoV-2, including serology and molecular assays and devices to house the assays. Developing new technologies to diagnose Lyme disease, E. coli, HIV, Ebola, MRSA, among others. Side projects include alternative readouts for molecular diagnostics, i.e. electrochemistry, electronics and controlling materials mechanical properties with CRISPR-Cas enzymes.

Collins Lab at the Wyss Institute, Wyss Institute at Harvard University.

E25Bio

Cambridge, MA

2017-current

E25Bio is a spin-off company from my Ph.D thesis (Gehrke lab). I originally developed the market analysis and plans for the company from within the Translational Fellows Program (TFP, MIT). While the program was reserved for postdocs and scientists, I was one of the first graduate students admitted to the program. The company started in 2017, and I currently continue to collaborate with them. My usual role is to help E25Bio develop better analysis tools for the clinical trials of their diagnostic devices. I also help with scale up production of their diagnostic devices and training new personnel.

Graduate Research at MIT: PhD

Cambridge, MA

2013-2017

Thesis title: "Immunochromatography assays to diagnose tropical viral pathogens using gold nanoparticles".

Committee: Prof. K. Vandiver, Prof. L. Gehrke, Prof. K. Hamad-Schifferli, Prof. R. Karnik

Development of lateral flow immunoassays, low-cost lab-on-a-chip devices for the diagnosis of tropical diseases. Focus on Dengue, Zika, Chikungunya, Ebola, Marburg. Synthesis and functionalization of gold nanoparticles for the detection of disease. Design, assembly and clinical validation of point of care, lateral flow assays and ELISA diagnostics. Expertise in virus cultures, hybridoma maintenance, BSL2+, flow cytometry. My research led to the development of E25Bio, a diagnostics startup.

Gehrke Lab, Institute for Medical Engineering and Science, MIT-IMES; and Department of Microbiology and Immunobiology, Harvard University.

Graduate Research at MIT: Master of Science (M.S.)

Cambridge, MA

2010-2012

Thesis title: "Control of blood clotting using gold nanorods"

Control blood coagulation by laser excitation of nanoparticle-DNA conjugates. Characterization of protein coronas surrounding nanoparticles. Quantification of the interactions at the nanoscale.

Hamad-Schifferli Lab, Departments of Mechanical Engineering and Biological Engineering, MIT

PUBLICATIONS

Overall: 20 publications, 10 of them as a first-author. My research has been published in Science, Science Translational Medicine, ACS Nano, among others.

* denotes equally contributing first-authors

20. R. Lee, H. de Puig, P. Q. Nguyen, N. M. Angenent-Mari, N. M. Donghia, J. P. McGee, J. D. Dvorin, C. M. Klapperich, N. R. Pollock, J. J. Collins. "Ultrasensitive CRISPR-based diagnostic for field-applicable detection of *Plasmodium* species in symptomatic and asymptomatic malaria". **PNAS**, 2020
19. A. Reddy, I. Bosch, B. B. Herrera, N. Salcedo, H. de Puig, D. Caicedo-Borrero, C. Narváez, I. Lorenzana, K. García, L. Parham, M. Hiley, D. García, M. Diamond, L. Gehrke. "Development and validation of a rapid lateral flow E1/E2-antigen test and ELISA in patients infected with emerging Asian strains of Chikungunya virus in the Americas". *Viruses*, 2020.
18. R. V. Gayet*, H. de Puig*, M. A. English*, L. R. Soenksen*, N. M. Angenent-Mari, A. S. Mao, P. Q. Nguyen, and J. J. Collins. "Creating CRISPR-responsive smart materials for diagnostics and programmable cargo release", **Nature Protocols**, 2020
17. I. Bosch, A. Reddy, H. de Puig, F. Perdomo-Celis, C. F. Narváez, A. Versiani, D. Fandos, M. L. Nogueira, M. Singla, R. Lodha, G. R. Medigeshi, I. Lorenzana, J. E. Ludert, H. V. Ralde, M. Gélvez-Ramírez, L. Villar, M. Hiley, L. Mendoza, N. Salcedo, B. B. Herrera, L. Gehrke; "Serotype-specific detection of dengue viruses in a nonstructural protein 1-based enzyme-linked immunosorbent assay validated with a multi-national cohort". *PLOS Neglected Tropical Diseases*, 2020
16. H. de Puig, I. Bosch, J.J. Collins, L. Gehrke. "Point-of-Care Devices to Detect Zika and Other Emerging Viruses". *Annual Reviews in Biomedical Engineering*, 2020.
15. M. A. English*, L. R. Soenksen*, R. V. Gayet*, H. de Puig*, N. M. Angenent-Mari, A. S. Mao, P. Q. Nguyen, and J. J. Collins. "Programmable CRISPR-Responsive Smart Materials", **Science**, 2019

Covered by >100 press articles.

14. C. Rodríguez-Quijada, H. de Puig, C. Yelleswarapu, J. J. Evans, J. P. Celli, Kimberly Hamad-Schifferli. "Protease degradation of protein coronas and its impact on cancer cells and drug payload release", *ACS Applied Materials & Interfaces*, 2019
13. C. Rodríguez-Quijada, M. Sánchez-Purrà, H. de Puig, K. Hamad-Schifferli. "Physical properties of biomolecules at the nanomaterial interface", *Journal of Physical Chemistry B*, 2018,
12. M. Sánchez-Purrà, B. Roig, A. Versiani, C. Rodríguez-Quijada, H. de Puig, I. Bosch, L. Gehrke, K. Hamad-Schifferli, "Design of SERS nanotags for multiplexed lateral flow immunoassays", *Molecular Systems Design and Engineering*, 2017, 2, 401-409

11. I. Bosch*, H. de Puig*, M. Hiley, M. Carré Camps, F. Perdomo-Celis, C.F. Narváez, D.M. Salgado, D. Senthooor, M. O'Grady, E. Phillips, A. Durbin, D. Fandos, H. Miyazaki, C-W- Yen, M. Gélvez-Ramírez, R. Warke, L.S. Ribeiro, M. Texeira, R. Almeida, J.E. Muñoz-Medina, J. Ludert, M.L. Nogueira, T.E. Colombo, A.Z. Terzian, P. Bozza, F. Bozza, M. Trugilho, T. Moreno, A. Bospo, E-T- Marques, B.N. Restrepo, K. Marín, S. Mattar, Y.R. Vieira, G. Barbosa-Lima, A. Vizzoni, J.C. Neto, A.S. Calheiros, D. Olson, M. Lucera, E.J. Asturias, M. Singla, G. Medigeshi, N. de Bosch, J. Tam, J. Gómez-Márquez, C. Clavet, L.A. Villar-Centeno, K. Hamad-Schifferli, L. Gehrke, "Rapid Antigen Tests for Dengue Virus Serotypes and Zika Virus in Patient Serum", **Science Translational Medicine**, 2017, 9, eaan1589

Covered by >100 press articles.

10. H. de Puig, I. Bosch, L. Gehrke, K. Hamad-Schifferli, "Challenges of the nano-bio interface in lateral flow and dipstick immunoassays", *Trends in Biotechnology*, 2017.
9. M. Sánchez-Purrà, M. Carré-Camps, H. de Puig, I. Bosch, L. Gehrke, K. Hamad-Schifferli, "Surface-enhanced Raman spectroscopy-based sandwich immunoassays for multiplexed detection of Zika and dengue viral biomarkers". *ACS Infectious Diseases*, 2017.
8. H. de Puig, I. Bosch, M. Carre, K. Hamad-Schifferli, "Effect of protein corona on antibody-antigen binding in nanoparticle sandwich immunoassays", 2017, *Bioconjugate Chemistry*, 28(1), 230-238
7. J. Tam, H. de Puig, C. Yen, I. Bosch, J. Gómez-Marquez, C. Clavet, K. Hamad-Schifferli, L. Gehrke. "Optimizing dengue detection in paperfluidic rapid diagnostics", *Journal of Immunoassay and Immunochemistry*, 2016
6. H. de Puig, J. Tam, C. Yen, L. Gehrke, K. Hamad-Schifferli. "The extinction coefficient of gold nanostars", *Journal of Physical Chemistry C*, 110, 17408-17415
5. C. Yen, H. de Puig, J. Tam, J. Gómez-Márquez, I. Bosch, K. Hamad-Schifferli, L. Gehrke. "Multicolored Silver Nanoparticles for Multiplexed Disease Diagnostics: Distinguishing Dengue, Yellow Fever, and Ebola viruses", 2015, *Lab on a Chip*, 15, 1638-1641.

Covered by >120 press articles.

4. S. Tibbits, L. Kara'in, J. Schaeffer, H. de Puig, J. Gomez-Marquez, A. Young, "DNA disPLAY: Programmable Bioactive Materials Using CNC Patterning", 2014, *Architectural Design*, 84 (4).
3. A. Cifuentes Rius*, H. de Puig*, J. C.-Y. Kah, S. Borros, K. Hamad-Schifferli, "Optimizing the Properties of the Protein Corona Surrounding Nanoparticles for Tuning Payload Release", 2013, *ACS Nano*,7(11).
2. H. de Puig, A. Cifuentes Rius, D. C. Flemister, S.H. Baxamusa, K. Hamad-Schifferli, "Selective Light-Triggered Release of DNA from Gold Nanorods Switches Blood Clotting On and Off", 2013, *PLoS ONE* 8(7): E68511.

Covered by >40 press articles.

1. H. de Puig*, S. Federici*, S. H. Baxamusa, P. Bergese, K. Hamad-Schifferli, "Quantifying the nano-machinery of the nanoparticle-biomolecule interface", *Small*, 2011, 7 (17), 2477–2484.

PATENTS

11. J.J. Collins, H. De Puig, P. Nguyen, L. Soensken, N. Donghia, A. Huang, N. Angenent "Face mask using wearable synthetic biology". US Provisional Application 63/110, 243
10. J.J. Collins, H. De Puig, P. Nguyen, L. Soensken, N. Donghia, A. Huang, N. Angenent "Fiber-optic integrated textiles with embedded freeze-dried cell-free reactions for wearable sensors" US Provisional Application 63/110,237
9. J.J. Collins, E. Zhao, X. Tan, A. Mao, H. de Puig, et al. "Riboswitch modules and methods for controlling eukaryotic protein translation". U.S. Provisional Application 63/038,536
8. J.J. Collins, D. E. Ingber, H. de Puig, P. Jolly. "Device and Method for analyte detection". U.S. Provisional Application 62/936,038
7. J.J. Collins, D. E. Ingber, H. de Puig, P. Jolly. "On-Chip assay strategy for the development of electrochemical readout for CRISPR-Cas diagnostics". U.S. Provisional Application 62/928,841.
6. J. J. Collins, H. de Puig, L. Soenksen, M.A. English, R. Gayet. "DNA-responsive hydrogels, methods of altering a property of a hydrogel, and applications thereof." U.S. Application No.: 62/823,272
5. L. Gehrke, K. Hamad-Schifferli, I. Bosch, C. Yen, J. Tam, H. de Puig. Multicolor nanoparticles for multiplexing lateral flow assays. PCT International Application No. PCT/US16/17557
4. L. Gehrke, K. Hamad-Schifferli, J. Gomez-Marquez, I. Bosch, H. de Puig. Anti-Dengue Virus NS1 Protein Monoclonal Antibodies. U.S. Application No.: 62/293990
3. L. Gehrke, I. Bosch, H. de Puig. Antibodies to Zika Virus NS1 Protein, and Pair-Wise Specific Detection of Zika Virus NS1 Protein in a Rapid Test. U.S. Application No.: 62/325530

2. L. Gehrke, H. de Puig, K. Hamad-Schifferli, I. Bosch. Specific Rapid Antigen Diagnostic Tests Based on Cross-Reactive Monoclonal Antibodies. U.S. Application No.: 62/523309
1. K. Hamad-Schifferli, H. de Puig, S.H. Baxamusa. A Method to Reversibly Control Blood Clotting Using Laser Light. US Patent Pending US 2015-0272899

CONFERENCE PRESENTATIONS (HIGHLIGHTS)

Overall: >20 conference presentations, 16 oral presentations and invited talks in conferences.

- International Symposium of Emerging Diseases, 2018. Universidad Autónoma de Guadalajara. Invited speaker. *"Synthetic biology approaches for the rapid diagnosis of mosquito-borne diseases"*
- Materials Research Society (MRS) Fall Boston, 2017. Oral Communication. *"Effect of the Protein corona in nanoparticle-assisted lateral flow immunoassays for the detection of Zika."*
- Materials Research Society (MRS) Fall Boston, 2017. Oral Communication. *"Rapid immunochromatography assays for Dengue virus serotypes and Zika virus in patient serum."*
- MIT-TATA Center symposium. 2017. Poster and invited speaker. *"Diagnosis of Dengue, Zika and Chikungunya in lateral flow immunoassays"*.
- International Symposium of Emerging Diseases, 2017. Universidad Autónoma de Guadalajara. Oral communication. Invited speaker. *"Use of nanoparticles for rapid diagnosis of viral disease"*
- Materials Research Society (MRS) Fall Boston, 2016. Oral Communication. *"Diagnosis of Dengue, Zika and Chikungunya using gold nanoparticles in lateral flow immunoassays."*
- American Chemical Society (ACS) ACS Colloid and Surface Science Symposium, Harvard University, 2016. Oral Communication. *"Diagnosis of tropical viral diseases in lateral flow immunoassays."*
- Materials Research Society (MRS) Fall Boston, 2015. Oral Communication. *"Increasing the sensitivity of lateral flow devices for the diagnosis of tropical diseases by optimizing the gold nanoparticle properties."*
- American Chemical Society (ACS) Boston National Meeting, 2015. Oral Communication. *"Detection of biological threats using gold nanoparticles in lateral flow immunoassays: Dengue hemorrhagic fever"*
- American Chemical Society (ACS) Boston National Meeting, 2015. Oral Communication. *"Loading and releasing payloads from protein coronas surrounding gold nanoparticles"*
- Materials Research Society (MRS) Fall Boston, 2014. Oral Communication. *"Engineering the protein corona surrounding nanoparticles for biomedical applications"*
- Materials Research Society (MRS) Fall Boston, 2014. Oral Communication. *"Engineering gold nanoparticles for lateral flow devices to detect tropical diseases"*
- Materials Research Society (MRS) Spring San Francisco, 2013. Oral Communication. *"Gold nanorod optical switch for controlling blood clotting"*
- European Materials Research Society (E-MRS), Nice 2011 Spring meeting. Oral Communication. *"Control of blood clotting using gold nanorods"*

OTHER ACTIVITIES

Ad hoc reviewer for Mexico Conacyt grants, fronteras de la ciencia, 2019-2020

Ad hoc reviewer for the Materials Research Society and the Royal Chemical Society.

Thesis committee member for master's thesis defense in Institut Quimic de Sarrià, IQS.

Winner team in Hack Lyme, health hackathon, 2017 by Bay Area Lyme Foundation.

Board member of the Spain@MIT student association (2011-2014).

Fun fact: 2009 National Spanish Reining Reserve Champion, CTO* ESP, CRN* (equestrian sport).

LANGUAGES

Spanish and Catalan – Native languages

English – Fluent