CARLOS HONRADO

MSc, PhD

· International Iberian Nanotechnology Laboratory (INL), Braga, Portugal ·

· carlos.honrado@inl.int ·

Biomedical Engineer with a broad interdisciplinary background and 7+ years of experience in research. Proficient in various microfluidic techniques, laboratory equipment and software. Constantly striving for excellence, always aiming to improve, learn and grow as a professional. Thrives on diverse environments, where team work and professionalism are key. Main research focus covers the development of microfluidic devices for biomedical use, including label-free techniques for single-cell sorting and analysis, dielectric characterization of cells and technology integration. His PhD at the University of Southampton focused on using and integrating analysis and separation techniques to study a myriad of human pathogens. He further explored microfluidic tools for the analysis, characterization and enrichment of relevant biological samples (e.g. tumor cells, extracellular vesicles, neural stem cells, and pathogenic bacteria) as a Postdoctoral Research Associate at the University of Virginia. He is now a Research Fellow in the Medical Devices group at the International Iberian Nanotechnology Laboratory (INL).

SKILLS

- Single-cell Impedance Cytometry
- Dielectrophoretic Cell Sorting
- Deterministic Lateral Displacement Cell Sorting
- Flow Cytometry
- Device Design
- Soft Lithography
- Photolithography
- Rapid Prototyping
- Micromachining
- SolidWorks
- AutoCAD
- MATLAB
- Biophysical Modelling
- Machine Learning

EXPERIENCE

NOVEMBER 2021 – PRESENT

POST-DOCTORAL RESEARCH FELLOW, INT. IBERIAN NANOTECHNOLOGY LABORATORY

Project: Development of an innovative platform to mimic tumoral vascular microenvironment of metastatic colorectal cancer patients for disease monitoring and inform therapeutic approach.

MARCH 2021 – PRESENT

GUEST EDITOR, MICROMACHINES, MDPI

Invited Guest Editor of the Special Issue on "*Microfluidics for Label-free Particle Sorting and Characterisation*" in the journal Micromachines.

AUGUST 2018 – SEPTEMBER 2021

POST-DOCTORAL RESEARCH ASSOCIATE, UNIVERSITY OF VIRGINIA, USA

Project: Development of devices and instrumentation for label-free single-cell cytometry for applications such as: cellular organelle related studies within oncology, stem cell analysis and cell transplant therapies, antibiotic susceptibility of microbials, and cell related studies in hematology.

SEPTEMBER 2014 – AUGUST 2018

PhD STUDENT – MARIE CURIE EARLY STAGE RESEARCHER, UNIV. OF SOUTHAMPTON, UK

Thesis title: "*Label-free Single Particle Analysis and Separation*".
Part of the European Union's Seventh Framework Program project – Label-free Particle Sorting.

JULY 2017 – AUGUST 2017

VISITING RESEARCHER, LUND UNIVERSITY, SWEDEN

Project: Sample-to-answer impedance cytometry integrated deterministic lateral displacement towards field-detection of blood parasites.

NOVEMBER 2016 – DECEMBER 2016

VISITING RESEARCHER, MICRONIT MICROTECHNOLOGIES, THE NETHERLANDS

Project: Development of a user friendly platform for the integration of different microfluidic techniques into a single, inexpensive and re-usable microdevice.

JANUARY 2015, JULY 2015 – AUGUST 2015, JANUARY 2017 – MARCH 2017

VISITING RESEARCHER, UNIV. OF GLASGOW, UK

Projects: Dielectric characterization of *Plasmodium falciparum*-infected red blood cells and dielectric analysis of *Leishmania mexicana*-infected bone-marrow macrophages using a portable fluorescence-coupled microfluidic impedance cytometer.

AUGUST 2013 – JUNE 2014

VISITING STUDENT – ERASMUS PROGRAM, UNIV. OF SOUTHEASTERN NORWAY, NORWAY

Thesis title: "*Study of Microfluidic Pumping and Detection Solutions for Portable Biomedical Devices*"

SEPTEMBER 2009 – JUNE 2014

INTEGRATED MASTER'S IN BIOMEDICAL ENGINEERING, UNIV. OF MINHO, PORTUGAL

Undergraduate studies spanned from biochemistry, mechanics, programming, human physiology to materials science, for example. Master's program in Medical Electronics, covering areas such as image processing, systems design, biosensors or microfabrication.

TEACHING

2014 – 2018

DEMONSTRATOR – BIONANOTECHNOLOGY (ELEC 6205), UNIV. OF SOUTHAMPTON, UK

Introduction to soft lithography techniques, surface modification, contact angle measurements, fluorescence microscopy imaging and protein micro-contact printing.

EDUCATION

SEPTEMBER 2014 – AUGUST 2018

DOCTOR OF PHILOSOPHY - PhD, UNIVERSITY OF SOUTHAMPTON, UK

Thesis title: "*Label-free Single Particle Analysis and Separation*".

SEPTEMBER 2009 – JUNE 2014

MASTER OF SCIENCE - MSc, UNIVERSITY OF MINHO, PORTUGAL

Thesis title: "*Study of Microfluidic Pumping and Detection Solutions for Portable Biomedical Devices*"

LANGUAGES

- Portuguese (Native)
- English (Bilingual)
- Spanish (Intermediate)

PUBLICATIONS

"Apoptotic Bodies in the Pancreatic Tumor Cell Culture Media Enable Label-Free Drug Sensitivity Assessment by Impedance Cytometry"
C. Honrado, S.J. Adair, J.H. Moore, A. Salahi, T.W. Bauer & N.S. Swami
Adv. Biology, 2021, 2100438, DOI: 10.1002/adbi.202100438

"Single-cell microfluidic impedance cytometry: from raw signals to cell phenotypes using data analytics"
C. Honrado[¢], P. Bisegna, N.S. Swami & F. Caselli
Lab Chip, 2021, 21 (22-54), DOI: 10.1039/D0LC00840K

"*Label-Free Quantification of Cell Cycle Synchronicity of Human Neural Progenitor Cells Based on Electrophysiology Phenotypes*"
C. Honrado[¢], N. Michel, J.H. Moore, A. Salahi, V. Porterfield, M.J. McConnell & N.S. Swami
ACS Sens., 2021, 6-1 (156-165), DOI: 10.1021/acssensors.0c02022

"*Self-aligned sequential lateral field non-uniformities over channel depth for high throughput dielectrophoretic cell deflection*"
X. Huang[¢], K. Torres-Castro, W.B. Varhue, A. Salahi, A. Rasin, C. Honrado[¢], A. Brown, J. Guler & N.S. Swami
Lab Chip, 2021, 21 (835-843), DOI: 10.1039/D0LC01211D

"*Quantifying bacterial spore germination by single-cell impedance cytometry for assessment of host microbiota susceptibility to Clostridioides difficile infection*"
J.H. Moore, A. Salahi [†], C. Honrado [†], C. Warburton, C.A. Warren & N.S. Swami
Biosens. Bioelectron., 2020, 166 (112440), DOI: 10.1016/j.bios.2020.112440

"*A neural network approach for real-time particle/cell characterization in microfluidic impedance cytometry*"
C. Honrado[†], J.S. McGrath [†], R. Reale [†], P. Bisegna, N.S. Swami & F. Caselli
Anal. Bioanal. Chem., 2020, 412 (3835-3845), DOI: 10.1007/s00216-020-02497-9

"*Rapid in Vitro Assessment of Clostridioides difficile Inhibition by Probiotics Using Dielectrophoresis to Quantify Cell Structure Alterations*"
J.H. Moore [†], C. Honrado[†¢], V. Stagnaro, G. Kolling, C.A. Warren & N.S. Swami
ACS Infect. Dis., 2020, 6-5 (1000-1007), DOI: 10.1021/acsinfecdis.9b00415

"*High-throughput dynamical analysis of dielectrophoretic frequency dispersion of single cells based on deflected flow streamlines*"
K. Torres-Castro, C. Honrado, W.B. Varhue, V. Farmehini & N.S. Swami
Anal. Bioanal. Chem., 2020 , 412 (3847-3857), DOI: 10.1007/s00216-020-02467-1

"*Electrophysiology-based stratification of pancreatic tumorigenicity by label-free single-cell impedance cytometry*"
J. S. McGrath[†], C. Honrado[†], J.H. Moore, S.J. Adair, W.B. Varhue, A. Salahi, V. Farmehini, B.J. Goudreau, S. Nagdas, E.M. Blais, T.W. Bauer & N.S. Swami
Anal. Chim. Acta, 2020, 1101 (90-98), DOI: 10.1016/j.aca.2019.12.0339

"*AC electrokinetic biased Deterministic Lateral Displacement for tunable particle separation*"
V. Calero, P. García-Sánchez, C. Honrado, A. Ramos & H. Morgan
Lab Chip, 2019, 19 (1386-1396), DOI: 10.1039/c8lc01416g

"*Dielectric characterization of Plasmodium falciparum infected red blood cells using microfluidic impedance cytometry*"
C. Honrado, L. Ciuffreda, D. Spencer, L. Ranford-Cartwright & H. Morgan
J. R. Soc. Interface, 2018, 15 (147), DOI: 10.1098/rsif.2018.0416

"*Analysis of Parasitic Protozoa at the Single-cell Level using Microfluidic Impedance Cytometry*"
J. S. McGrath[†], C. Honrado[†], D. Spencer, B. Horton, H. L. Bridle & H. Morgan
Scientific Reports, 2017, 7 (2601), DOI: 10.1038/s41598-017-02715-y

"*Dielectric characterisation and identification of malaria-infected red blood cells using microfluidic impedance cytometry*"
C. Honrado, L. Ciuffreda, D. Spencer, L. Ranford-Cartwright & H. Morgan
Conference Proceedings: MicroTAS 2016, 20th International Conference on Miniaturized Systems for Chemistry and Life Sciences

"*Microfluidic impedance cytometry for species-level discrimination of waterborne protozoa*"
J. S. McGrath[†], C. Honrado[†], D. Spencer, B. Horton, H. L. Bridle & H. Morgan
Conference Proceedings: MicroTAS 2015, 19th International Conference on Miniaturized Systems for Chemistry and Life Sciences

"*Development and optimization of an integrated capillary-based opto-microfluidic device for chemiluminescence quantitative detection*"
C. Honrado & T. Dong
J. Micromech. Microeng., 2014, 24 (125023), DOI: 10.1088/0960-1317/24/12/125023

"*A capacitive touch screen sensor for detection of urinary tract infections in portable biomedical devices*"
C. Honrado & T. Dong
Sensors, 2014 14 (8), DOI: 10.3390/s140813851

"*Design and characterization of a multiplexed capillary-driven lab-on-chip for water quality analysis*"
C. Honrado, C. A. Silva & T. Dong
Conference Proceedings: MeMeA 2014, IEEE International Symposium on Medical Measurements and Applications, DOI: 10.1109/MeMeA.2014.6860084

[†]*Authors contributed equally to this work*
[ç]*Created the art for selected journal cover*

ORAL PRESENTATIONS

"*Machine learning for automated impedance-based phenotypic classification*"
C. Honrado – Invited speaker on Workshop 5: "*Single-Cell Data Analytics*"
MicroTAS 2021, 25th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Palm Springs, CA, USA & Online, 2021

"*Electrophysiology-based assessment of drug sensitivity of pancreatic cancer subpopulations using machine learning*"
C. Honrado, S.J. Adair, J.H. Moore, A. Salahi, J. S. McGrath, W.B. Varhue, V. Farmehini, B.J. Goudreau, S. Nagdas, E.M. Blais, T.W. Bauer & N.S. Swami
DEP 2020.1, 4th International Conference on Dielectrophoresis, Flagstaff, AZ, USA & Online, 2021

"*Identification and dielectric characterisation of malaria-infected red blood cells using fluorescence-coupled impedance cytometry*"
C. Honrado, L. Ciuffreda, D. Spencer, L. Ranford-Cartwright & H. Morgan
European Workshop on Label-free Particle Sorting, Lund University, Sweden, 2017

"*Design and characterization of a multiplexed capillary-driven lab-on-chip for water quality analysis*"
C. Honrado, C. A. Silva & T. Dong
MeMeA 2014, IEEE Int. Symposium on Medical Measurements & Applications,Lisbon,Portugal, 2014

POSTER PRESENTATIONS

"*Impedance-based biophysical stratification of secreted apoptotic bodies in culture media for drug sensitivity assessment of pancreatic tumors*"
C. Honrado, S.J. Adair, J.H. Moore, A. Salahi, T.W. Bauer & N.S. Swami
MicroTAS 2021, 25th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Palm Springs, CA, USA & Online, 2021

"*Impedance cytometry of apoptotic bodies to quantify drug sensitivity of pancreatic tumor xenografts*"
C. Honrado, J.H. Moore, S.J. Adair, A. Salahi, T.W. Bauer & N.S. Swami
MicroTAS 2020, 24th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Online, 2020

"*Label-free assessment of cell cycle synchronization in neural progenitor cells by impedance cytometry*"
C. Honrado, N. Michel, J.H. Moore, A. Salahi, V. Porterfield, M.J. McConnell & N.S. Swami
MicroTAS 2020, 24th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Online, 2020

"*Quantifying fate bias of neural stem and progenitor cells by single-cell impedance cytometry*"
C. Honrado, J.H. Moore, A. Jiang, A. Yale, J.S. McGrath, L. Flanagan & N.S. Swami
ARMi Symposium 2019, 4th Annual Mid-Atlantic Biomanufacturing Symposium, Charlottesville, USA, 2019

"*High-throughput single-cell impedance phase contrast cytometry of patient derived pancreatic tumor xenografts to stratify tumorigenicity*"
C. Honrado, J.S. McGrath, J.H. Moore, S. Adair, T. Bauer & N.S. Swami
MicroTAS 2019, 23rd International Conference on Miniaturized Systems for Chemistry and Life Sciences, Basel, Switzerland, 2019

"*Stratifying pancreatic tumorigenicity based on single-cell phenotypic analysis of subcellular electrophysiology*"
C. Honrado, J.S. McGrath, J.H. Moore, S. Adair, T. Bauer & N.S. Swami
BMES 2019, Biomedical Engineering Society Annual Meeting, Philadelphia, USA, 2019

"*Quantifying fate bias of neural stem and progenitor cells by single-cell impedance cytometry*"
C. Honrado, J.H. Moore, A. Jiang, A. Yale, J.S. McGrath, L. Flanagan & N.S. Swami
BMES 2019, Biomedical Engineering Society Annual Meeting, Philadelphia, USA, 2019

"*Dielectric characterisation and identification of malaria-infected red blood cells using microfluidic impedance cytometry*"
C. Honrado, L. Ciuffreda, D. Spencer, L. Ranford-Cartwright & H. Morgan
MicroTAS 2016, 20th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Dublin, Republic of Ireland, 2016

"*Dielectric characterisation and identification of malaria-infected red blood cells using microfluidic impedance cytometry*"
C. Honrado, L. Ciuffreda, D. Spencer, L. Ranford-Cartwright & H. Morgan
Nanoelectronics & Nanotechnology Annual Conference 2016, University of Southampton, UK, 2016
Awarded Best Poster Presentation

"*Label-free characterization and sorting of human pathogens*"
C. Honrado, J. S. McGrath, L. Ciuffreda, D. Spencer, H. L. Bridle, L. Ranford-Cartwright & H. Morgan
Nanoelectronics & Nanotechnology Annual Conference 2015, University of Southampton, UK, 2015

PATENTS

"*Apoptotic bodies in the pancreatic tumor cell culture media enable label-free drug sensitivity assessment by impedance cytometry*"
N.S. Swami, C. Honrado & T.W. Bauer
U. S. Provisional Patent Application No. 63/185,129, filed May 6th, 2021

"*System and method for recognition of cellular subpopulations in impedance data clusters*"
N.S. Swami & C. Honrado
U. S. Provisional Patent Application No. 63/114,324, filed November 16th, 2020

"*System and method for quantifying bacterial spore germination by single-cell impedance cytometry for assessment of host microbiota susceptibility to infection*"
N.S. Swami, C.A. Warren, J.H. Moore, C. Honrado & A. Salahi
U. S. Provisional Patent Application No. 63/054,601, filed July 21st, 2020

"*Quantifying phenotypic heterogeneity by single-cell and single-aggregate impedance cytometry for selective downstream isolation based on subcellular and extracellular phenotypes*"
N.S. Swami, J. S. McGrath, W.B. Varhue, C. Honrado & V. Farmehini
U. S. Provisional Patent Application No. 62/736,685, filed September 26th, 2018

OUTREACH & ENTREPRENEURSHIP

MAY 2021
Pint of Science - Braga, Portugal - Invited Speaker

OCTOBER 2020 - APRIL 2021
UVA Entrepreneurship Cup, USA - part of "*ReSep Biotechnology*" team, focused on the collection of circulating tumor cells (CTCs) from liquid biopsies using re-circulating dielectrophoresis (DEP)

JULY & SEPTEMBER 2016
Open day – Electronic Biomedical Engineering Lab demonstrations, University of Southampton, UK

JULY 2016
Photolithography Demonstration for High school students, University of Southampton, UK

MARCH 2016
Science and Engineering Festival, University of Southampton, UK

REFERENCES

NOVEMBER 2021 – PRESENT
Dr. Lorena Diéguez, International Iberian Nanotechnology Laboratory, Portugal
Supervisor at INL, contact: lorena.dieguez@inl.int

AUGUST 2018 – SEPTEMBER 2021
Prof. Nathan Swami, University of Virginia, USA
Supervisor at UVA, contact: nswami@virginia.edu

SEPTEMBER 2014 – AUGUST 2018

Prof. Hywel Morgan, University of Southampton, UK

PhD Supervisor, contact: hm@ecs.soton.ac.uk

SEPTEMBER 2014 – AUGUST 2018

Dr. Daniel Spencer, University of Southampton, UK

PhD Supervisor, contact: d.c.spencer@soton.ac.uk

SEPTEMBER 2014 – AUGUST 2017

Prof. Jonas Tegenfeldt, Lund University, Sweden

LAPASO Project Coordinator & secondment host, contact: jonas.tegenfeldt@ftf.lth.se

AUGUST 2013 – JUNE 2014

Prof. Tao Dong, University of Southeastern Norway, Norway

MSc Supervisor, contact: tao.dong@usn.no

AUGUST 2013 – JUNE 2014

Prof. Carlos Silva, University of Minho, Portugal

MSc Supervisor, contact: csilva@dei.uminho.pt