Debora Monego

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CURRENT POSITION

MSCA Postdoctoral Fellow,
Max Planck Institute for Polymer Research, Mainz, Germany 2024–Present
Advisor: Prof. Dr. Frauke Gräter

- My current research focuses on the investigation of mechanochemical properties of collagen using a combination of classical mechanics and bioinformatics techniques.

EDUCATION

Ph.D. in Chemistry, University of Sydney, Sydney, Australia 2016–2020

- Dissertation: *Effect of Surface Ligands on Colloidal Stability, Shape and Sedimentation of Apolar Nanoparticles*
  Advisor: Dr. Asaph Widmer-Cooper

M.Sc. in Chemistry, Federal University of Santa Maria, Santa Maria, Brazil 2014–2016

- Dissertation: *The Free Radical Scavenging Activity of Neurosporene: A Theoretical Study*
  Advisor: Prof. Paulo Cícero do Nascimento

B.Sc. in Physics, Federal University of Santa Maria, Santa Maria, Brazil 2009–2016

- Dissertation: *Study of the alignment of* TiO_2 *Nanorods with Applications in Liquid Crystal Devices*
  Advisors: Prof. Luiz Fernando Schelp and Prof. Mary O'Neill (University of Hull)

B.Sc. in Chemistry, Federal University of Santa Maria, Santa Maria, Brazil 2008–2012

ACADEMIC EXPERIENCE

Postdoctoral Researcher, HITS, Heidelberg, Germany 2023–2024

Research visit, University of Harvard Medical School, Boston, United States Sep–Nov 2023

- Used bioinformatics and evolutionary models to analyze the evolutionary patterns of collagen sequences and identify the specific mutations that correlate with disease manifestations observed in clinical settings. Ongoing collaboration with Prof. Debora Marks.

Postdoctoral Research Fellow and Lecturer in Chemistry, Columbia University, New York, United States 2020–2022

- Studied the dynamics of cells in biological tissues with the goal of explaining the sorting and migration of cancer cells. Ongoing collaboration with Prof. Laura Kaufman's and Prof. David Reichman's groups.
- Education research: co-developed interactive simulation tool and POGIL-based activity to teach statistics to first year students. Currently evaluating the effectiveness of this approach in promoting student learning in comparison to more traditional approaches (e.g., lecturing).

Graduate Research Assistant, University of Sydney, Sydney, Australia 2016–2020

- Used molecular dynamics simulations to study the structure and interaction between nanoparticles, as well as their stability to aggregation in solution in collaboration with different experimental groups

Collaboration with Theoretical Physics Group, Federal University of Santa Maria, Santa Maria, Brazil 2014–2016

– Worked on various projects (also outside my thesis work) using quantum mechanics simulations and spectroscopic methods to evaluate the antioxidant activity of carotenoid compounds

Summer Project, University of Hull, Hull, United Kingdom 2013–2014

– Investigated the phase separation of nematic liquid crystalline semiconductors in organic photovoltaics

TEACHING EXPERIENCE

Lecturer in Chemistry, Columbia University, New York, United States 2020–2022

– Frontiers of Science (SCNCCC1100): Core Curriculum science course, required for first year students at Columbia College

- Developed content for modules in Neuroscience, Physics, Biophysical Chemistry, and Earth Science and taught two weekly seminars (22 students each)
- Wrote and graded homework and exams
- Contributed to curriculum development
- Designed material and quiz questions, and contributed to curriculum development of an online version of the course (MOOC at EdX)

Columbia University Science Honors Program instructor, Columbia University, New York, United States 2021–2022

– Co-created and taught 10-week course titled "Volcanoes" for 10th-12th grade students

Postgraduate Teaching Fellow, University of Sydney, Sydney, Australia 2019–2020

– Fundamentals of Chemistry 1B (CHEM1012)
– Chemistry 1A (CHEM1111)
– Chemistry 1B (CHEM1112), Advanced (CHEM1912), Special Studies Program (CHEM1992)

Demonstrator for Chemistry Labs, University of Sydney, Australia 2019–2020

– Experimental Chemistry 1A (CHEM1111)

Tutor for Disabilities Services Office, University of Sydney, Sydney, Australia 2018–2019

– Forensic and Environmental Chemistry (CHEM2404)
– Chemical Structure and Stability (CHEM2402)
– Proteins in Cells (BCMB2002)
– Immunology (IMM2011)

SELECTED HONORS AND AWARDS

Marie Skłodowska-Curie Actions Postdoctoral Fellowship 2024

Isabel Rojas Travel Award, Awarded by HITS for a research visit to the Blavatnik Institute at Harvard Medical School, US (3000 EUR) 2023

Innovative Course Design + SOLER Grant, Columbia University (5000 USD) 2022

A&S Equity and Diversity Activities Grant, Columbia University (2000 USD) 2022

ACIS Best Thesis Award for 2021, Australian Colloid and Interface Society 2022

Columbia Science Fellowship, Columbia University 2020–2022

Columbia Science Fellowship Research Grant, Columbia University (12000 USD) 2020

Awarded Humboldt Research Fellowship Programme for Postdoctoral Researchers, Heidelberg Institute for Theoretical Studies (declined) 2020

Le Févre Student Lecture Award, University of Sydney
Awarded to three outstanding PhD students in the final year of their studies 2019

RJW Le Févre Research Travelling Scholarship, University of Sydney (3000 AUD) 2019

RACI Travel Bursary, Royal Australian Chemical Institute 2019

First place in the Annual Publications Prize, ARC Centre of Excellence in Exciton Science Workshop 2018

Overseas Travel Fellowship, Awarded by The Australian Nanotechnology Network for a research visit to INM Leibniz Institute for New Materials, Germany (3000 AUD) 2018

University of Sydney Nano Institute Postgraduate Supplementary Scholarship, Awarded to postgraduate candidates in recognition of excellent work in the fields of nanoscale science and technology 2018–2020

University of Sydney Postgraduate Research Scholarship 2016–2020

Master's Scholarship, Coordination for the Improvement of Higher Education Personnel (CAPES, Brazil) 2014–2016

Science Without Borders Scholarship, Awarded to study Physics at the University of Hull, UK 2013–2014

Asociación de Universidades Grupo Montevideo Scholarship, Awarded to study at the Universidad Nacional del Litoral, Argentina 2010

PUBLICATIONS | Google Scholar Profile

1. D. Monego, S. Dutta, D. Grossman, M. Krapez, P. Bauer, J. Margaritat, B. Mahler, A. Widmer-Cooper, and B. Abécassis "Ligand-Induced Incompatible Curvatures Control Ultrathin Nanoplatelet Polymorphism and Chirality", *PNAS*, **2024**, 121 (9) e2316299121.
2. B. Rennekamp, C. Karfusehr, M. Kurth, A. Ünal, D. Monego, K. Riedmiller, G. Gryn'ova, D. M Hudson, F. Gräter "Collagen breaks at weak sacrificial bonds taming its mechanoradicals", *Nature Communications*, **2023**, 14, 2075.
3. D. Monego, T. Kister, N. Kirkwood, D. D. Jimenez, P. Mulvaney, T. Kraus, A. Widmer-Cooper "When like destabilizes like: Inverted solvent effects in apolar nanoparticle dispersions", *ACS Nano*, **2020**, 14, 5278–5287.
4. D. Monego, T. Kister, N. Kirkwood, P. Mulvaney, A. Widmer-Cooper, T. Kraus "Colloidal Stability of Apolar Nanoparticles: Role of Ligand Length", *Langmuir*, **2018**, 34, 12982-12989.
5. T. Kister, D. Monego, P. Mulvaney, A. Widmer-Cooper, T. Kraus "Colloidal stability of apolar nanoparticles: The role of particle size and ligand shell structure", *ACS Nano*, **2018**, 12, 5969-5977.
6. V. Dal Prá, J. F. Soares, D. Monego, R. G. Vendruscolo, D. M. G. Freire, M. Alexandri, A. Koutinas, R. Wagner, M. A. Mazutti, M. B. Da Rosa "Comparison of Different Compressed Fluids for Residual Oil Extraction from Palm Kernel Cake", *Waste and Biomass Valorization*, **2018**, 9, 265-271.
7. D. Monego, M. B. da Rosa, P. C. do Nascimento "Applications of computational chemistry to the study of the antiradical activity of carotenoids: A review", *Food Chemistry*, **2017**, 217, 37-44.
8. F. B. Pires, C. B. Dolwitsch, V. dal Pra, H. Faccin, D. Monego, L. M. de Carvalho, C. Viana, O. Lameira, F. O. Lima, L. Bressan, M. B. da Rosa "Qualitative and quantitative analysis of the phenolic content of *Connarus* var. *angustifolius*, *Cecropia obtusa*, *Cecropia palmata* and *Mansoa alliacea* based on HPLC-DAD and UHPLC-ESI-MS/MS", *Revista Brasileira de Farmacognosia*, **2017**, 27, 426-433.
9. F. B. Pires, C. B. Dolwitsch, V. dal Pra, D. Monego, V. M. Schneider, R. R. F Loose, M. E. P. Schmidt, L. Bressan, M. A. Mazutti, M. B. da Rosa "An Overview about the chemical composition and Biological Activity of Medicinal species found in the Brazilian Amazon", *Journal of Applied Pharmaceutical Science*, **2016**, 6, 233-238.
10. V. Dal Prá, J. F. Soares, D. Monego, R. G. Vendruscolo, D. M. G. Freire, M. Alexandri, A. Koutinas, R. Wagner, M. A. Mazutti, M. B. Da Rosa "Extraction of bioactive compounds from palm (Elaeis guineensis) pressed fiber using different compressed fluids", *The Journal of Supercritical Fluids*, **2016**, 112, 51-56.

SEMINAR TALKS | ~ presented virtually, ** invited

1. **_Physics of Cancer_, September, 2024, Leipzig, Germany, "How collagen translates mechanical forces to oxidative stress"
2. **_IUTAM: Theoretical and numerical developments in cellular mechanobiology_, June, 2024, Sevilla, Spain, "Exploring the Evolutionary Mechanisms of Collagen as a Protein Material"
3. **_MRS Spring Meeting_, April, 2024, Seattle, United States, "Empowering Diversity: Inclusive Strategies in STEM Education"
4. _Single Molecule Biophysics Meeting_, January, 2024, Les Houches, France, "How collagen turns mechanical into oxidative stress: Insights from coevolution"
5. _ACS Fall Meeting_, August, 2023, San Francisco, United States, "Sacrificial bonds deter oxidative stress from mechanoradicals in collagen"
6. _ACS Fall Meeting_, August, 2023, San Francisco, United States, "Frontiers of Science Inclusivity Discussions: Moving toward inclusive STEM classrooms by including students' voices"
7. _Hünfeld Workshop_, April, 2023, Hünfeld, Germany, "Size-dependent Sedimentation of Nanocrystals: The Role of the Ligand Shell Structure"
8. _Columbia Science Spotlight Lecture Series_, April, 2022, New York, United States, "How tiny is the future? Harnessing the Nanoscale"
9. _Columbia Science Spotlight Lecture Series_, March, 2021, New York, United States, "Zooming in: using computer simulations to understand nanoparticles"
10. _Statistical Mechanics of Soft Matter_, December, 2019, Adelaide, Australia, "Size-dependent sedimentation of nanocrystals: the role the ligand shell structure"
11. **_Le Févre Student Lectureships_, September, 2019, Sydney, Australia, "Ligand-mediated interactions between nanoparticles"
12. _9th Australian Colloid and Interface Symposium_, February, 2019, Hobart, Australia, "Colloidal stability of apolar nanoparticles: effect of ligand and solvent structure"
13. _Quantum and Computational Chemistry Student Conference_, December, 2018, Australian National University's Kioloa campus, "Understanding nanoparticles"
14. _Statistical Mechanics of Soft Matter_, December, 2018, Auckland, New Zealand, "Ligand-Mediated Interaction Between Nanoparticles"
15. _Australian Symposium on Computationally Enhanced Materials Design_, July, 2018, Sydney, Australia, "Ligand-Mediated Interaction Between Nanoparticles"
16. _Chemistry Postgraduate Symposium_, September, 2017, University of Sydney, Sydney, Australia, "Ligand-Mediated Interaction Between Nanoparticles"

POSTER PRESENTATIONS

1. _35th Molecular Modelling Workshop 2023_, Match, 2023, Erlangen, Germany, "Size-dependent sedimentation of nanocrystals: the role of the ligand shell structure"
2. _Liquid Matter Conference_, July, 2021, Virtual, "Colloidal stability of Apolar Nanoparticles"
3. _Chemistry and Physics of Liquids Gordon Research Conference_, August, 2019, Holderness, New Hampshire, United States, "Colloidal stability of Apolar Nanoparticles"
4. _Telluride School on Theoretical Chemistry_, August, 2019, Telluride, Colorado, United States, "Colloidal stability of Apolar Nanoparticles"
5. _Sydney Surfaces And Soft Stuff Meeting_, May, 2019, Sydney, Australia, "Ligand-Mediated Interactions Between Nanoparticles"
6. _Chemistry Postgraduate Symposium_, November, 2018, University of Sydney, Sydney, Australia, "Ligand-Mediated Interactions Between Nanoparticles"
7. _ARC Centre of Excellence in Exciton Science Annual Workshop_, September, 2018, Melbourne,

Australia, "Ligand-Mediated Interactions Between Nanoparticles"

8. *16th Conference of the International Association of Colloid and Interface Scientists*, May, 2018, Rotterdam, Netherlands, "Ligand-Mediated Interactions Between Nanoparticles"
9. *International Conference on Nanoscience and Nanotechnology*, February, 2018, Wollongong, Australia, "Ligand-Mediated Interactions Between Nanoparticles"
10. *Statistical Mechanics of Soft Matter*, November, 2017, Sydney, Australia, "Ligand-Mediated Interactions Between Nanoparticles"
11. *IUPAC Meeting*, July, 2017, São Paulo, Brazil, "Ligand-Mediated Interactions Between Nanoparticles"

MENTORSHIP

Columbia University

– Anish Chandra Nanjappa, Undergraduate Student 2022–Present
– Seojin You, Undergraduate Student 2022–Present
– Angel Latt, Undergraduate Student 2020–2024

University of Sydney

– Leo Jiang, Undergraduate Student 2019
  - Currently a Graduate Student in Mathematics at University of Toronto
– Marion Kaprez, Visiting Undergraduate Student 2018
  - Currently a Graduate Student in Chemistry at ESPCI Paris - PSL
– James Smith, Honours Student 2017
  - Honours thesis: The Effect of Ligand Branching on the Solubility of Nanoparticles
– Thomas Hagan, Undergraduate Student 2017
  - Currently a Graduate Student in Biology at University of Sydney

COMMUNITY INVOLVEMENT AND OUTREACH

HITS Open Day, talk on "Solving Biological Puzzles with Computer Simulations" July 2024

SciencePub Heidelberg, talk on "Proteins under Force" May 2024

23rd juFORUM Congress, talk on "Forceful Interactions: The role of collagen in biological mechanics" April 2024

Symposium at SMBE23: Science for everybody: education and outreach in molecular biology and evolution, Co-organizer July 2023

Coding for Science Workshop, Columbia University, Content leader and co-organizer November 2022

Tools for integrating anti-racist/inclusive pedagogy into STEM instruction at Columbia, Reading and discussion group co-coordinator 2022–present

Skype a Scientist, Volunteer with four K-6 and two K-8 classrooms 2021–present

Podcast Diffusion Science radio, Interview about nanoscience 2019

Famelab Australia, Semi-finalist 2019

SERVICE AND MEMBERSHIPS

Sydney University Chemical Society, Treasurer 2018

Reviewer for the following journals: Soft Matter, Nature Communications, Materials Science, Langmuir, Journal of Physical Chemistry, Columbia Undergraduate Science Journal

Memberships: ACS, APS, RACI, ACIS

RESEARCH REFERENCES

Prof. Dr. Frauke Gräter, *Postdoctoral Advisor*
Heidelberg Institute for Theoretical Studies and University of Heidelberg
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Prof. David Reichman, *Postdoctoral Advisor*
Department of Chemistry, Columbia University
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Prof. Asaph Widmer-Cooper, *Ph.D. Advisor*
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TEACHING REFERENCES

Dr. Ivana Nikolic Hughes, *Director, Frontiers of Science Course*
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