

CURRICULUM VITAE

Ionel Popa, Ph.D.

Assistant Professor

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I. EDUCATION

- 2010 Ph.D. University of Geneva, Geneva, Switzerland
Colloids and Single Molecules, advisor: Michal Borkovec
- 2005 B.S. Gh. Asachi Technical University, Iasi, Romania
Chemical Engineering, valedictorian among 250 students

II. PROFESSIONAL APPOINTMENTS

- 2015-present Assistant Professor, Department of Physics,
University of Wisconsin Milwaukee, Milwaukee, WI
- 2015 Associate Research Scientist, Department of Biological Sciences,
Columbia University, New York, NY
- 2010-2015 Postdoctoral Researcher, Department of Biological Sciences,
Columbia University, New York, NY
- 2005-2010 Teaching and Research Assistant (Assistant-doctorant), University of
Geneva, Switzerland

III. AWARDS AND HONORS

- 2009 59th Lindau Nobel Laureate Meeting, Young Scientist Nomination
- 2008 Swiss Chemical Society Mettler Toledo prize
- 2003-2005 Merit scholarship (1 for every 500 students) & 12 awards for Research
Projects, awarded by Gh. Asachi Technical University

IV. GRANTS AND FELLOWSHIPS

- 2012 Swiss National Science Foundation fellowship for advanced postdocs
- 2011 Swiss National Science Foundation fellowship for early career postdocs
- 2010 Swiss National Science Foundation fellowship for early career postdocs

V. PUBLICATIONS

Peer-Reviewed Papers

1. Rivas-Pardo J.A., Eckels E.C., **Popa, I.**, Kosuri P., Linke W.A., Fernandez J. M., Work Done by Titin Protein Folding Assists Muscle Contraction, *Cell Reports*, **2016**, 14 (6), 1339-134.
2. Valle-Orero J., Eckels E.C., Stirnemann G., **Popa, I.**, Berkovich R., Fernandez J. M., The elastic free energy of a tandem modular protein under force, *Biochem. Biophys. Res. Co.*, **2015**, 460 (2), 434-438.
3. Chen H., Yuan,G., Winardhi, R.S., Yao M., **Popa, I.**, Fernandez J. M., Yan J., Dynamics of equilibrium folding and unfolding transitions of titin immunoglobulin domain under constant forces, *J. Am. Chem. Soc.*, **2015**, 137, 3540-3546.
4. Saqlain F, **Popa, I.**, Fernandez J. M., Alegre-Cebollada S., A Novel Strategy for Utilizing Voice Coil Servoactuators in Tensile Tests of Low Volume Protein Hydrogels, *Macromol. Mater. Eng.*, **2015**, 300, 369-376.
5. **Popa, I.**, Kosuri P., Alegre-Cebollada J., Garcia-Manyes S., Fernandez J. M., Force dependency of biochemical reactions measured by single-molecule force-clamp spectroscopy, *Nat. Protocols*, **2013**, 8 (7): 1261-1276.
6. **Popa, I.**, Berkovich R., Alegre-Cebollada S., Badilla C.L., Rivas-Pardo J.A., Taniguchi Y., Kawakami M., Fernandez J. M., Nanomechanics of HaloTag Tethers, *J. Am. Chem. Soc.*, **2013**, 135 (34), 12762–12771.
7. Berkovich R., Hermans R.I., **Popa I.**, Stirnemann G., Garcia-Mayners S., Berne B.J., Fernandez J.M., Rate limit of protein elastic response is tether dependent, *Proc. Nat. Acad. Sci. USA*, **2012**, 109, 14416-14421.
8. Borkovec M., Szilagyí I., **Popa I.**, Finessi M., Sinha P., Maroni P., Papastavrou G., Investigating Forces Between Charged Particles in the Presence of Oppositely Charged Polyelectrolytes with the Multi-Particle Colloidal Probe Technique, *Adv. Colloid Interface Sci.*, **2012**, 179-182, 85-98.
9. Sinha P., **Popa I.**, Finessi M., Ruiz-Cabello F.J.M., Szilágyi I., Maroni P., and Borkovec M., Exploring Forces between Individual Colloidal Particles with the Atomic Force Microscope, *Chimia*, **2011**, 66, 214-217. (**SCS-Metrohm Foundation Award**).

10. **Popa I.**, Fernandez J.M., and Garcia-Manyes S., Direct Quantification of the Attempt Frequency Determining the Mechanical Unfolding of Ubiquitin, *J. Biol. Chem.*, **2011**, 286, 31072-31079.
11. Finessi M., Sinha P., Szilagyí S., **Popa I.**, Maroni P., and Borkovec M., Charge Reversal of Sulfate Latex Particles by Adsorbed Linear Poly(ethylene imine) Probed by Multiparticle Colloidal Probe Technique, *J. Phys. Chem. B*, **2011**, 115, 9098-9105.
12. Muresan L., Maroni P., **Popa I.**, Porus M., Longtin R., Papastavrou G., and Borkovec M., Conformational Changes of Polyamidoamine (PAMAM) Dendrimers Adsorbed on Silica Substrates, *Macromolecules*, **2011**, 44, 5069–5071.
13. **Popa I.**, Sinha P, Finessi M., Maroni P., Papastavrou G., and Borkovec M., Importance of Charge Regulation in Attractive Double-Layer Forces between Dissimilar Surfaces, *Phys. Rev. Lett.*, **2010**, 104, 228301.
14. **Popa I.**, Zhang B., Maroni P., Schlüter A.D., and Borkovec M., Large Mechanical Response of Single Dendronized Polymers Induced by Ionic Strength, *Angew. Chem., Int. Ed.*, **2010**, 49, 4250-4253.
15. **Popa I.**, Papastavrou G., and Borkovec M., Charge Regulation Effects on Electrostatic Patch-Charge Attraction Induced by Adsorbed Dendrimers, *Phys. Chem. Chem. Phys.*, **2010**, 12, 4863-4871.
16. Jiang M., **Popa I.**, Maroni P., and Borkovec M., Adsorption of Poly-L-lysine on Silica Probed by Optical Reflectometry, *Colloids Surf., A.*, **2010**, 360, 20-25.
17. **Popa I.**, Gillies G., Papastavrou G., and Borkovec M., Attractive and Repulsive Electrostatic Forces between Positively Charged Latex Particles in the Presence of Anionic Linear Polyelectrolytes, *J. Phys. Chem. B.*, **2010**, 114, 3170-3177.
18. **Popa I.**, Papastavrou G., and Borkovec M., Effective Charge of Adsorbed Poly(amido amine) Dendrimers: Transition from Heterogeneous to Homogeneous Charge Distribution, *Macromolecules*, **2010**, 43, 1129-1136.
19. **Popa I.**, Papastavrou G., Borkovec M., Trulsson M., and Jonsson B., Long-Ranged Attractive Forces Induced by Adsorbed Dendrimers: Direct Force Measurements and Computer Simulations, *Langmuir*, **2009**, 25, 12435-12438.
20. **Popa I.**, Gillies G., Papastavrou G., and Borkovec M., Attractive Electrostatic Forces between Identical Colloidal Particles Induced by Adsorbed Polyelectrolytes, *J. Phys. Chem. B*, **2009**, 113, 8458-8461.

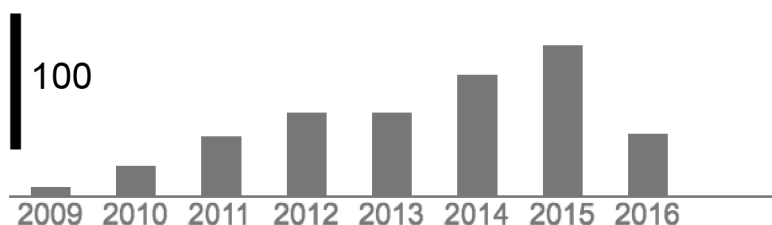
21. **Popa I.**, Longtin R., Maroni P., Papastavrou G., and Borkovec M., Adsorption and Self-Organization of Dendrimers at Water-Solid Interfaces, *Chimia*, **2009**, 63, 279-282. (**SCS Mettler-Toledo Award**).
22. **Popa I.**, Cahill B. P., Maroni P., Papastavrou G., and Borkovec M., Thin Adsorbed Films of a Strong Cationic Polyelectrolyte on Silica Substrates, *J. Colloid Interface Sci.*, **2007**, 309, 28-35.
23. Carja G., **Popa I.**, Ciobanu, G., and Aelenei N., Mixed Oxides Derived from Vanadium Substituted Layered Double Hydroxides as Catalysts Precursors for SO₂ Oxidation, *Environ. Eng. Manage. J.*, **2002**, 1(3), 307-311.
24. Lisă G., Aelenei N., Curteanu S., and **Popa I.**, Mathematical Processing of Vapor Pressure, *Proc. Rom. Acad. B, Series B: Chem. Life Sci. Geosci.*, **2002**, 4, 2.

Conference Papers

1. Eckels E.C., Rivas-Pardo J.A., Valle-Orero J., **Popa I.**, Fernandez J.M., The Science of Stretching: Mechanical Anisotropy in Titin Ig Domains, *Biophys.J.*, **2016**, 110 (3), 393a.
2. Valle-Orero J., Eckels E.C., **Popa I.**, Rivas-Pardo J.A., Fernandez J.M., Proving the Role of Entropic Elasticity in Protein Folding, *Biophys.J.*, **2016**, 110 (3), 180a.
3. Rivas-Pardo J.A., Eckels E.C., **Popa I.**, Kosuri P., Linke W.A., Fernández J.M., Protein Folding Drives Muscle Contraction, **2016**, *Biophys.J.*, 110 (3), 636a.
4. **Popa I.**, Rivas-Pardo J.A., Eckels E.C., Valle-Orero J., Kahn T.B., Berkovich R., Stirnemann G., Chen H., Fernandez V.I., Berne B.J., Yan J., Fernandez J.M., Revisiting the Free Energy of Modular Proteins under Force, **2015**, *Biophys.J.*, 108 (2), 355a.
5. JA Rivas Pardo J.A., Eckels E.C., **Popa I.**, Kosuri P., Linke W.A., Fernández J.M., Direct Observation of Titin Immunoglobulin Domain Unfolding-Refolding in Muscle Sarcomeres, **2015**, *Biophys.J.*, 108 (2), 170a.
6. **Popa I.**, Berkovich R., Alegre-Cebollada J., Rivas-Pardo J.A., Fernandez J.M., Halotag Tethers to Study Titin Folding at the Single Molecule Level, **2014**, *Biophys.J.*, 106 (2), 391a.
7. Kosuri P., **Popa I.**, Alegre-Cebollada J., Fernandez J.M., Single Molecule Oxidative Folding, **2012**, *Biophys.J.*, 102 (3), 174a.
8. **Popa I.**, Garcia-Manyes S., Fernandez J.M., Temperature Dependence of the Mechanical Unfolding of Single Ubiquitin Proteins, **2011**, *Biophys.J.*, 100 (3), 398a.

Publication Statistics

Citation indices	All	Since 2011
Citations	468	431
h-index	14	14
i10-index	16	15



source: Google Scholar

VI. SCHOLARLY DEVELOPMENT

Presentations

2016 Popa I., The Physics of Proteins under Force, Biomedical Engineering Joint Seminar Series, Marquette University/University of Wisconsin Milwaukee/Medical College of Wisconsin, Milwaukee, USA, March 25th.

2015 Popa I., Uncovering the nano-mechanics of proteins using a novel single molecule approach, The University of Manchester, Manchester, UK, June 10th.

2015 Popa I., Uncovering the Nano-mechanics of Giant Muscle Protein Titin using a Novel Single Molecule Approach, University of Wisconsin Milwaukee, Milwaukee, USA, April 30th.

2015 Popa I., Rivas-Pardo J.A., Eckels E.C., Valle-Orero J., Kahn T.B., Berkovich R., Stirnemann G., Chen H., Fernandez V.I., Berne B.J., Yan J., Fernandez J.M., Revisiting the free energy of proteins under force using magnetic tweezers, Biophysical Society 59th Annual Meeting, Baltimore, USA, February 7-11.

2013 Popa I., Protein yoga; studying titin folding on the human timescale, Columbia University Biological Sciences Retreat, Tarrytown, USA, September 26-28.

2013 Popa I., Mechanochemistry of single molecules: from physical interactions and chemical bonds to dynamics of proteins, invited talk, University of Zurich, February 8th.

2012 Popa I., Colloidal Interactions and mechano-elastic properties of proteins and polymers studied with force spectroscopy, Theory and Experiment on Surface Physics, Interfaces and Nanoparticles, Bucharest, Romania, September 26-28.

2009 Popa I., Papastavrou G., and Borkovec M., Attraction between patterned surfaces: going beyond the van der Waals interaction, 13th IACIS International Conference on Surface and Colloid Science, New York, USA, June 14-19.

2008 Popa I., Papastavrou G., and Borkovec M., Electrostatic Interactions between colloidal particles covered with oppositely charged dendrimers, Swiss Chemical Society Fall Meeting, Zürich, Switzerland, September 11th.

2008 Popa I., Papastavrou G., and Borkovec M., Attractive forces between well-defined heterogeneously charged surfaces, 22nd Conference of the European Colloid and Interface Society, Krakow, Poland, September 1-5.

Posters

2014 Popa I., Fernandez J.M., Single Molecule Highthroughput Force Spectroscopy, IDBR: Workshop on Successful Approaches for Development and Dissemination of Instrumentation for Biological Research, Rosslyn, VA, USA, May 1-2.

2014 Popa I., Berkovich R., Alegre-Cebollada J., Badilla C., Fernandez J.M., HaloTag tethers to study titin folding at the single molecule level, 58th Annual Meeting - Biophysical Society, San Francisco, CA, USA, February 15-19.

2012 Popa I., Berkovich R., Alegre-Cebollada J., Badilla C., Fernandez J.M., Single Molecule Covalent Tethering - A New Approach for Long Measurements Under Force, Gordon Research Conferences - Single Molecule Approaches to Biology, West Dover, VT, USA, July 15-20.

2012 Popa I., Badilla C. and Fernandez J.M., Single Molecule Covalent Attachment for Force Spectroscopy Measurements, 56th Annual Meeting - Biophysical Society, San Diego, CA, USA, February 25-29.

2011 Popa I., Fernandez J.M., and Garcia-Manyes, S., Temperature Dependence of the Mechanical Unfolding of Single Ubiquitin Proteins, 55th Annual Meeting - Biophysical Society, Baltimore, MD, USA, March 5-9.

2009 Popa I., Gillies, G., Papastavrou G., and Borkovec M., Electrostatic Patch-Charge Attraction induced by Adsorbed Polyelectrolytes, Fall Meeting of the Swiss Chemical Society, Lausanne, Switzerland, September 4th.

2008 Popa I., Maroni P., Papastavrou G., and Borkovec M., Adsorption study of a linear polyelectrolyte on an oppositely charged surface, 22nd Conference of the European Colloid and Interface Society, Krakow, Poland, September 1-5.

2007 Popa I., Papastavrou G., and Borkovec M., Surface induced formation of supermolecular dendrimer/polyelectrolyte complexes, 21st Conference of the European Colloid and Interface Society, Geneva, Switzerland, September 10-14.

2006 Popa I., Cahill B. P., and Borkovec M., Polyelectrolyte adsorption on oppositely charged surfaces: a reflectometry study, Swiss Chemical Society Fall Meeting, Zürich, Switzerland, October 13th.

VII. RESEARCH EXPERIENCE

1. Single Protein Biophysics:

Protein folding – I am interested in the fundamental process of folding of proteins under mechanical force. The vectorial nature of force makes single molecule force spectroscopy techniques uniquely suited to study proteins that perform under mechanical load. I have extensive experience in working with titin, a giant protein responsible with the elasticity of muscles and with bacterial proteins, such as those involved in adhesive junctions.

Instrument development – I have developed a new single molecule technique based on magnetic tweezers, to investigate mechanical properties of proteins at physiological forces and on human time-scale (hours to days). This technique allows for the first time the study of slow physiological processes and low probability events, such as misfolding or redox reactions.

Surface chemistry – critical to single molecule experiments is the attachment of proteins to tethering surfaces, which needs to survive the applied mechanical perturbation. I have implemented a new covalent attachment chemistry that combines surface chemistry and protein engineering and yields unprecedented attachment specificity and strength.

2. Mechano-medicine:

Screening for mechano-active compounds - current screening techniques use fluorescence as a marker for potential drug activity. Yet these methods cannot be applied to conditions related to failure of proteins that operate under force. I am currently working on an automated technique capable of screening for mechano-active compounds by applying physiological forces to single proteins in the presence of compounds from screening libraries. The first case-study protein is talin, an essential constituent of the focal adhesions of cells.

Biocompatible materials – I expect that protein based materials will become central to developing new biocompatible materials. Initial experiments of gels made from proteins that operate in vivo under force show unique elastic properties given by the folding/unfolding of the constituent domains inside these materials.

3. Charged-driven Interactions in Colloids:

Colloidal suspensions are extensively used for water purification, paper making or cosmetics and drug formulations. I have developed a new technique based on colloidal probes to study interactions between colloidal particles at particle pair level and directly probed for the first time the attraction forces that appear due to distribution of charges in patches on the surface of these particles.

VIII. TEACHING

University of Wisconsin Milwaukee

306 Introduction to Biophysics
309 Physics III – Modern Physics
705 Molecular, Cellular and System Biophysics

University of Geneva

General Chemistry Laboratory
Analytical Chemistry I

IX. STUDENT SUPERVISION

University of Wisconsin Milwaukee

Narayan Prasad Dahal (graduate student) – *Multidomain proteins under Force*
Kirill Shmilovich (undergraduate student) – *Modeling Protein Hydrogel under Force*
Nicholas De Leo (undergraduate student) – *Fluid Cell Development*
Gevork Seifert (undergraduate student) – *Synthesis of Protein Hydrogels*
Fiona Pantoga-Montoto (high school student) – *Adsorption of fluorescent proteins for single molecule FRET experiments*
Sarah (Katie) Eder (high school student) – *Development of fluid chambers using 3D printing techniques*

Columbia University (all undergraduate students)

Farees Saqlain – *Study of protein hydrogels*
Jaykar Anmol Nayeck – *Algorithms for real-time particle tracking*
Alex Lee – *Study of the biotin-streptavidin interaction*
Ido Haimi – *Microfluidic devices to study bacterial adhesion*

Kang Joon Ho – *Protein degradation by ClpXP studied at single molecule level*
Diego Rojas – *Protein purification to analyze AAA+ proteolytic machine in vitro*
Shayna Busch – *Fluorescent labeling of thioredoxin enzyme*

X. SERVICE TO PROFESSION

Reviewer for *Colloids Surf., A., Phys. Rev. Lett., Phys. Rev. E.*

XI. PROFESSIONAL MEMBERSHIPS (PRESENT AND PAST)

Biophysical Society
European Colloid and Interface Society
Swiss Chemical Society
Board of European Students of Technology.