

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

| NAME Christian A.M Wilson | | POSITION TITLE Associate Professor | |
|---|----------------------------------|--|---|
| eRA COMMONS USER NAME yitowilson | | | |
| EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i> | | | |
| INSTITUTION AND LOCATION | DEGREE <i>(if applicable)</i> | YEAR(s) | FIELD OF STUDY |
| Faculty of Chemical and Pharmaceutical Science University of Chile | BA | 2008 | Biochemistry |
| Faculty of Sciences, University of Chile | Ph.D | 2011 | Molecular and Cell Biology, Neuroscience |
| University of California, Berkeley, USA | Postdoctoral training | 2011-2013 | Biophysics |

A. Personal Statement

Our laboratory focuses in single molecule manipulation of biomolecules. This area is a new field of research and allows studying the effect of the forces on the structure of proteins and the concomitant changes in their function. It also permits to determine the forces and torques developed in the course of the mechanochemical conversion in molecular motors. Inside the cell, mechanical forces are produced in molecular processes as diverse as transcription, replication, translation, chromosomal segregation, protein unfolding, translocation of proteins across the membranes and cellular movement. Now, our work is focused in determining the importance of the force associated to the domain movements of BiP (immunoglobulin heavy-chain binding protein) protein during protein translocation in the ER, also focusing in the kinetic properties of BiP and in the conformational changes that occur during its ATPase cycle, as it is working in the translocation process. However, it's still not clear the specific mechanism that BiP uses to perform its work during translocation. This is the reason of the great importance of a detailed study at the single molecule level which will provide information about this important mechanism. One aim is to determine the mechanochemical mechanism that BiP uses working in the translocation. To do this, we are focusing primarily on the study of individual molecules, with optical tweezers, and an innovative combination of magnetic tweezers with TIRF (Total Internal Fluorescence Reflection) using single molecule FRET (Förster Resonance Energy Transfer) dyes.

B. Positions and Honors.

- **Positions and Employment**

- 2018- Associate Professor, Faculty of Chemical and Pharmaceutical Science, University of Chile
- 2013-2018 Assistant Professor, Faculty of Chemical and Pharmaceutical Science, University of Chile
- 2011-2013 University of California, Berkeley, USA: Postdoctoral Fellow (Advisors: C. Bustamante and S. Marqusee)

- **Other Experience and Professional Memberships**

- 2017 Member of TWAS Young Affiliates Network (TYAN)
- 2017 Secretary of the Chilean Society for Biochemistry and Molecular Biology (SBBM)
- 2016 Member of TWAS Regional Office for Latin America and the Caribbean.
- 2015 Treasurer of The Chilean Society for Biochemistry and Molecular Biology (SBBM)
- 2013 Member of The Chilean Society for Biochemistry and Molecular Biology (SBBM)

2011 Member of The Biophysical Society

• Honors

- 2020 Appointment of "Honorary Member" of the National Association of Biochemistry Students (ANEB) Chile. ANEB. Santiago, Chile. August 20, 2020.
- 2019 Selected as a Researcher in the 2019-2021 Frontier Science Program of the Chilean Academy of Sciences. 5th Contest of the Frontier Science Program. Santiago, Chile. June 19, 2019.
- 2019 Obtaining a Travel Grant. I Contest, Travel Assistance Program 2019 to attend "Revisiting the Central Dogma of Molecular Biology at the Single-Molecule Level" in Lima, Perú.
- 2018 Recognition Award for his contribution to Research. Recognition granted within the framework of the 176th Anniversary of the University of Chile. Santiago, Chile. November 2018.
- 2017 Productivity Recognition Award "VIII Academic Productivity Contest" of the University of Chile, Faculty of Chemical and Pharmaceutical Sciences. May 18, 2017.
- 2016 Award for Recognition of Research, Innovation and Artistic Creation 2016 from the Vice President for Research and Development of the University of Chile. November 15, 2016.
- 2016 Obtaining a Travel Grant. II Contest, Travel Assistance Program 2016 to attend "The World Academy of Sciences Annual Meeting" in Kigali, Rwanda.
- 2013-2017 Reentry Grant, Faculty of Chemical and Pharmaceutical Science, University of Chile.
- 2013-2014 Promoting Research Opportunities for Latin American Biochemists (PROLAB), ASBMB (Pan-American Association for Biochemistry and Molecular Biology), PABMB (Pan-American Association for Biochemistry and Molecular Biology), IUBMB (International Union of Biochemistry and Molecular Biology), to travel to US for research 2013-2014.
- 2013 ASBMB 2013 Graduate/Postdoctoral travel award: Scholarship for attend to The American Society for Biochemistry and Molecular Biology (ASBMB) Annual Meeting. Boston, USA.
- 2011 Postdoctoral Fellowship in Global Health given by NIH Fogarty International Center.
- 2009-2010 CONICYT Grant Support Doctoral Thesis, number: 24090160.
- 2008 Panamerican Association of Biochemistry and Molecular Biology (PABMB) Scholarship for attend to XI Congress PABMB in Aguas de Lindoia, Brasil.
- 2008 The CONICYT Scholarship for International Fellowship: Doctoral thesis, University of California, Berkeley (Advisor: C.Bustamante).
- 2007-2011 CONICYT Scholarship for doctoral studies.

C. Contribution to Science (publications considered since 2017)

Alavi, Zahra; Casanova-Morales, N. Quiroga, D.; **Wilson, C.A.M.** "***Towards the understanding of molecular motors and its relationship with local unfolding***". Paper accepted for publication by **Quarterly Review Biophysics** (March 22, 2024).

Carrasco, V.; Berríos-Pastén, C.; Canales, N.; Órdenes A.; **Wilson, C.A.M.**; Monasterio, O. "Bioinformatics, thermodynamics, and mechanical resistance of the FtsZ-ZipA complex of Escherichia coli supports a highly dynamic protein interaction in the divisome". BBA General Subjects, 2023. <http://dx.doi.org/10.1016/j.bbagen.2023.130471>.

Rivera, M.; Burgos-Bravo, F.; Engelberger, F.; Ramírez-Sarmiento, C.; Baez, M.; Smith, S.B.; **Wilson, C.A.M.** Effect of temperature and nucleotide on the binding of BiP chaperone to a protein substrate. Protein Science. 2023. 32(7): e4706. <https://doi.org/10.1002/pro.4706>

Rivera, M.; Smith, S.B.; Baez, M.; **Wilson, C.A.M.** Temperature dependent mechanical unfolding and refolding of a protein studied by thermo-regulated optical tweezers. Biophysical journal. 2023. 122(3): 513-521. <https://doi.org/10.1016/j.bpj.2022.12.034>.

- Sánchez, W.N.; Robeson, L.; Carrasco, V.; Figueroa, N.L.; Burgos-Bravo, F.; **Wilson, C.A.M.**, Casanova-Morales, N. Determination of protein-protein interactions at the single-molecule level using optical tweezers. *Quarterly Reviews of Biophysics*. 2022. 55:e8. doi:10.1017/S0033583522000075.
- Mateluna, C.; Torres, P.; Rodríguez-Peña, M.; Silva, P.; Matthies, D.J.; Criollo, A.; Bikker F.J.; Bolscher, J.G.M.; **Wilson, C.A.M.**; Zapata-Torres, G.; Torres, V.A. Identification of VEGFR2 as the Histatin-1 receptor in endothelial cells. *Biochemical Pharmacology*. 2022. 201:115079. <https://doi.org/10.1016/j.bcp.2022.115079>.
- “Post-translational Protein Translocation Through Membranes at the Single Molecule Level” Diego Quiroga-Roger, Hilda M. Alfaro-Valdés and **Christian A.M. Wilson Moya**. Chapter of the book “Single-Molecule Science: From Super-Resolution Microscopy to DNA Mapping and Diagnostics” edited by Krishnarao Appasani & Raghu Kiran Appasani. Cambridge University Press. Pages 80-93. May 4, 2022. (ISBN: 9781108423366)
- Burgos-Bravo, F.; Martínez-Meza, S.; Quest, A.F.G.; **Wilson, C.A.M.**; Leyton, L. Application of force to a Syndecan-4 containing complex with Thy-1- α V β 3 Integrin accelerates neurite retraction. *Frontiers in Molecular Biosciences - Biophysics*. 2020. 7:582257. doi: 10.3389/fmolb.2020.582257.
- Peña-Oyarzun, D.; Rodríguez-Peña, M.; Burgos-Bravo, F.; Vergara, A.; Kretschmar, C.; Sotomayor-Flores, C.; Ramírez-Sarmiento, C.A.; de Smedt, H.; Reyes, M.; Perez, W.; Torres, V.A.; Morselli, E.; Altamirano, F.; **Wilson, C.A.M.**; Hill, J.A.; Lavandero, S.; Criollo, A. PKD2/polycystin-2 induces autophagy by forming a complex with BECN1. *Autophagy*. 2020. doi: 10.1080/15548627.2020.1782035
- Casanova-Morales, N.; Figueroa, N.L.; Alfaro, K.; Montenegro, F.; Barrera, N.P.; Maze, J.R.; **Wilson, C.A.M.**; Conejeros, P. Structural characterization of the saxitoxin-targeting APTSTX1 aptamer using optical tweezers and molecular dynamics simulations. *PLoS ONE*. 14(11): e0222468. 2019. doi: 10.1371/journal.pone.0222468
- “Mechanical Properties of Chaperone BiP, the Master Regulator of the Endoplasmic Reticulum” Hilda M. Alfaro- Valdés, Francesca Burgos- Bravo, Nathalie Casanova- Morales, Diego Quiroga- Roger and Christian A.M. Wilson. Chapter of the book “Endoplasmic Reticulum” de IntechOpen. DOI: 10.5772/intechopen.82080. December 4, 2018.
- Casanova-Morales, N.; Quiroga-Roger, D.; Alfaro-Valdés, H.M.; Alavi, Z.; Lagos-Espinoza, M.I.A.; Zocchi, G.; **Wilson, C.A.M.** Mechanical properties of BiP protein determined by nano-rheology. *Protein Science*. 27 (8), 1418- 1426, 2018. doi: 10.1002/pro.3432.
- Casanova-Morales, N.; Alavi, Z.; Wilson, C.A.M.; Zocchi, G. Identifying Chaotropic and Kosmotropic Agents by Nano-Rheology. *The Journal of Physical Chemistry Part B*. 2018. doi: 10.1021/acs.jpccb.7b12782.
- Paredes, A.J., Alfaro-Valdés, H.M., **Wilson, C.A.M.** DNA staining method based on formazan precipitation induced by blue light exposure. *J. Vis. Exp* (131) e56528, 2018. doi:10.3791/56528. <https://www.jove.com/video/56528/dna-staining-method-based-on-formazan-precipitation-induced-blue>
- Burgos-Bravo, F., Figueroa, N.L., Casanova-Morales, N., Quest, A.F.G., Wilson, C.A.M., Leyton, L. Single-molecule measurements of the effect of force on Thy-1/ α V β 3-integrin interaction using non-purified proteins. *Molecular Biology of the Cell*. 29 (3), 326-338, 2018. doi: 10.1091/mbc.E17-03-0133.
- Bustamante, A., Sotelo, J.C., Guerra, D.G., Floor, M., **Wilson, C.A.M.**, Bustamante, C., Baez, B. The Energy Cost of Polypeptide Knot Formation and its Folding Consequences. *Nature Communications*. 8(1), 1581, 2017. doi: 10.1038/s41467-017-01691-1.
- Ramírez M.P., Rivera M., Quiroga-Roger D., Bustamante A., Vega M., Baez M., Puchner E.M., **Wilson C.A.M.** Single molecule force spectroscopy reveals the effect of BiP chaperone on protein folding. *Protein Science*, 26 (7), 1404-1412, 2017.

Paredes A.J., Naranjo-Palma T., Alfaro-Valdés H.M., Barriga A., Babul J., **Wilson C.A.M.** New visible and selective DNA staining method in gels with tetrazolium salts. *Analytical Biochemistry: Methods in the Biological Sciences*. 517, 31-35, 2017.

Patents

Wilson, C.A.M., Contreras, G.I., and Babul, J. Applicant: Universidad de Chile. Método de visualización de biomoléculas a simple vista, tales como proteínas o ácidos nucleicos, sin la necesidad de usar compuestos potencialmente tóxicos, exposición a la luz ultravioleta (UV) o fluorescencia. Application Number (Chile): 201403000 INAPI. Filing Date: 05 November 2014. Status: Granted. registration date: 20 March 2018. Patent Number: 55630

D. Research Support (Projects considered since 2017)

Ongoing Research Support

Temperature-dependent molecular behavior of key players of the cold shock response of *E. coli*. Project Fondecyt Regular 1231276. April 2023- March 2027. Principal Investigator: Mauricio Baez. Co-investigator: Christian A.M. Wilson.

To understand the effect of protein glycosylation on BiP-mediated post-translational translocation and subsequent folding. Link Project - Fondecyt 2022 of the Vice-rectory of Research and Development of University of Chile. Code project: ENL 10/22. Principal investigator: Christian A.M. Wilson. August 2022 - August 2023.

Completed

The effect of macromolecular crowding and molecular chaperones on the spontaneous knot formation in a polypeptide chain and on the folding landscape of knotted proteins. Project Fondecyt Regular 1191153. April 2019- March 2023. Principal Investigator: Mauricio Baez. Co-investigator: Christian A.M. Wilson.

Research Internship at the Philipp Kukura Laboratory at the University of Oxford, England. EMBO Scientific Exchange Grant N°9880. October – December 2022. Principal Investigator: Christian A.M. Wilson.

Mechanochemical mechanism of BiP protein and its role in proteostasis and protein translocation. Project Fondecyt Regular 1181361. April 2018- March 2022. Principal Investigator: Christian A.M. Wilson. Co-investigator: Mauricio Baez.

Equipo de microscopia de fluorescencia confocal acoplado a pinzas ópticas para la manipulación y visualización simultánea de sistemas moleculares. Project Fondecyt Regular EQM180114. November 2018- May 2020. Principal Investigator: Mauricio Baez. Co-investigators: A. Quest; C. Hetz; Christian A.M. Wilson; D. Quiroga; G. Gunther; J. Babul; J. Morales; L. Leyton; L. Puente; M. Kogan; O. Orellana; R. Soto; V. Guixe.

Coupled optical tweezers for high resolution sensing of localized phenomena in single proteins. Project Fondecyt Regular 1171013. April 2017- March 2021. Principal Investigator: Carlos Saavedra. Co-Investigator: Christian A.M. Wilson

Noise spectroscopy of micro cantilevers: applications to protein dynamics. Project Fondecyt Regular 1161010. 2016-2020. Principal Investigator: Francisco Melo. Co-investigator: Christian A.M. Wilson.

Understanding the importance of the force associated to the domain movements of BiP during protein translocation in the endoplasmic reticulum. International Research Projects with Germany and the United States PII20150073. 2016-2019. Principal Investigator: Christian A.M. Wilson. (Universidad de Chile- University of California, Berkeley, USA).

Principal Investigator (Wilson, Christian A.M.)

Folding and degradation of proteins with knotted topologies: implications for folding of proteins, unfolding and translocation mechanism of ATP-dependent proteases (ClpXP). Project Fondecyt Regular 2015-2019. Principal Investigator: Mauricio Baez. Co-investigator: Christian A.M. Wilson

Effect of the forces involved in the conformational changes associated to the ligand binding and catalysis in Adenylate kinase at the single molecule level. Project Fondecyt Postdoctoral 2016-2018. Principal Investigator: Diego Quiroga Roger. Sponsor Research: Christian A.M. Wilson.

Mechanisms of Active Protein Translocation Through Membranes at the Single Molecule Level. Project Fondecyt de Iniciación 11130263. November 2013-November 2017. Principal Investigator