

# CURRICULUM VITAE

Pablo Fernando Martín Terán Arce  
Research Associate Professor  
Division of Translational and Regenerative Medicine, Department of Medicine  
Department of Biomedical Engineering  
University of Arizona  
Steele Children's Research Center, Room 7342  
1501 Campbell Avenue  
Tucson, AZ 86719  
E-mail: ftarce@email.arizona.edu  
Telephone: 520-626-7228 (office)

## Education

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|-----------|--------------------------------------|--|
| 1986-1993 | B.Sc. and M.Sc.<br>(Diplom Physiker) | Physics<br>Technical University of Munich,<br>Munich, Germany  |
| 1992-1993 | (Diplomarbeit)                       | Master's Thesis<br>Department of Structural Molecular Biology<br>Max Planck Institute for Biochemistry<br>Martinsried, Germany<br>Title: Scanning Tunneling Microscopy and Electrochemical Methods for<br>Prospective in situ Imaging of Biological Samples<br>Co-directors: Dr. R. Guckenberger and Dr. W. Baumeister       |
| 1995-1997 | Ph. D.                               | Physics,<br>Research Institute of Theoretical and Applied Physical Chemistry (INIFTA)<br>National University of La Plata, Argentina<br>Title: Scanning Probe Microscopy Applied to the Study of the Molecular<br>Structure and Surface Dynamics of Organic Monolayers<br>Co-directors: Dr. R. Salvarezza and Dr. A. J. Arvia |

## Employment

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|-----------------------|--|
| March-April 1988      | Student Laboratory Assistant<br>Research Department for Photovoltaic Cells,<br>Siemens (Neuperlach Süd), Munich, Germany                                   |
| Aug.-Oct. 1990        | Research Summer Student<br>Biophysics Section (supervisor Dr. Erich Sackmann),<br>Physics Department,<br>Technical University of Munich, Garching, Germany |
| 1994-1995             | Lecturer<br>Physics Department,<br>Universidad Mayor Tomás Frías/Mayor de San Simón (Bolivia)  |
| March 1998-April 2000 | Postdoctoral Fellow<br>Department of Physical Chemistry (supervisor Dr. Fausto Sanz),  |

University of Barcelona, Barcelona, Spain

- Aug. 1999-Feb. 2000      Visiting Research Scholar  
Materials Sciences Division (supervisor Dr. Miquel Salmeron),  
Lawrence Berkeley National Laboratory, Berkeley, CA
- May 2000-March 2001      Postdoctoral Fellow  
Department of Physics & Astronomy (supervisor Dr. Pulak Dutta),  
Northwestern University, Evanston, IL
- April 2001-May 2002      Research Associate  
Laboratory for Molecular Robotics (supervisor Dr. Aristides Requicha),  
Department of Computer Science,  
University of Southern California, Los Angeles, CA
- June 2002-Feb. 2006      Research Scientist and Postdoctoral Researcher  
Imaging and Chemical Analysis laboratory (supervisor Dr. Recep Avci),  
Department of Physics,  
Montana State University, Bozeman, MT
- Feb.-Sept. 2006              Postdoctoral Researcher  
Neuroscience Research Institute (supervisor Dr. Ratnesh Lal),  
University of California at Santa Barbara (UCSB), Santa Barbara, CA
- Oct. 2006-Dec. 2009      Research Associate (Assistant Professor)  
Center for Nanomedicine (supervisor Dr. Ratnesh Lal),  
Department of Medicine (Pulmonary/Critical Care Section),  
University of Chicago, Chicago, IL
- Jan. 2010-                      Assistant Project Scientist,  
Bioengineering, and  
Mechanical & Aerospace Engineering (supervisor Dr. Ratnesh Lal),  
University of California at San Diego (UCSD), La Jolla, CA

### **Professional Memberships**

- 2003-2004                  American Chemical Society (ACS)
- 2004-2005                  American Physical Society (APS)
- 2008-2013                  Biophysical Society

### **Honors and Awards**

- Australian Research Council (ARC). International Fellowship; ARC Linkage International grant (2009).
- Argentine Research Council (CONICET). Fellowship for foreign graduates (1995-1997).

### **Service/Outreach**

#### **National/international outreach**

Reviewer for:

- *Soft Matter*

- *Physical Chemistry Chemical Physics*
- *Nanomedicine: Nanotechnology, Biology, and Medicine*
- *Biochimica et Biophysica Acta (BBA) - Biomembranes*
- *Chemical Physics Letters*
- *Microscopy and Microanalysis*

## Publications

### Book chapters

1. **\*F. Teran Arce**, J. L. Zubimendi, M.E. Vela, R.C. Salvarezza, and A.J. Arvia. "Self-assembled monolayers on C(0001)", in "Adsorption by Carbons", Eduardo Bottani and Juan Tascón (editors), chapter 20 (Elsevier 2008).
2. **F. Teran Arce**, H. Jang, L. Connelly, S. Ramachandran, B. L. Kagan, R. Nussinov, and R. Lal. "Structure–Function Studies of Amyloid Pores in Alzheimer’s Disease as a Case Example of Neurodegenerative Diseases", in "Bionanoimaging: Protein Misfolding & Aggregation", Vladimir Uversky and Yuri Lyubchenko (editors), chapter 36 (Elsevier 2013).
3. Hyunbum Jang, **F. Teran Arce**, Joon Lee, Alan L. Gillman, Srinivasan Ramachandran, Bruce L. Kagan, Ratnesh Lal, and Ruth Nussinov. "Computational Methods for Structural and Functional Studies of Alzheimer’s Amyloid Ion Channels", in "Methods in Molecular Biology: Protein Amyloid Aggregation", David Eliezer (editor), chapter 16 (Springer 2015).

### Refereed journal articles

1. \*R. Guckenberger, **F. Terán Arce**, A. Hillebrandt, T. Hartmann. "Imaging of uncoated tobacco mosaic virus by scanning tunneling microscopy". *J. Vac. Sci. Technol. B* 12, 1508-1511 (1994).
2. **\*F. Terán Arce**, M. E. Vela, R. C. Salvarezza, A. J. Arvia. "Scanning probe microscopy comparative study of thiol films on C(0001) and Au(111) surfaces". *Surf. Rev. Lett.* 4, 637-649 (1997).
3. **\*F. Terán Arce**. "The scanning tunneling microscope (STM)". *Bolivian Journal of Physics* 4(4), 37-57(1998).
4. **\*F. Terán Arce**, M. E. Vela, R. C. Salvarezza, A. J. Arvia. "Evolution of a monolayer of dodecanethiol on gold followed in situ by scanning tunneling microscopy". *Electrochim. Acta* 44, 1053-1067 (1998).
5. **\*F. Terán Arce**, M. E. Vela, R. C. Salvarezza, A. J. Arvia. "The dynamic behavior of butanethiol and dodecanethiol adsorbates on Au(111) terraces". *J. Chem. Phys.* 109, 5703-5706 (1998).
6. **\*F. Terán Arce**, M. E. Vela, R. C. Salvarezza, A. J. Arvia. "A complex structural dynamics at adsorbed alkanethiol layers at Au(111) single crystal domains". *Langmuir* 14, 7203-7212 (1998).
7. **P. F. M. Terán Arce**, G. Andreu Riera, P. Gorostiza, F. Sanz. "Atomic-Layer Expulsion in Nanoindentations on an Ionic Single Crystal". *Appl. Phys. Lett.* 77, 839-841 (2000).
8. **F. Terán Arce**, R. Avci, I. B. Beech, K. E. Cooksey, B. Wigglesworth-Cooksey. "Microelastic properties of minimally adhesive surfaces: A comparative study of RTV11 and Intersleek elastomers". *J. Chem. Phys.*, 119, 1671-1682 (2003).
9. I. Diez-Perez, M. Luna, **F. Teheran**, D.F. Ogletree, F. Sanz, M. Salmeron. "Interaction of water with self-assembled monolayers of alkylsilanes on mica". *Langmuir*, 20, 1284-1290 (2004).

10. R. Avci, M. Schweitzer, R. Boyd, J. Wittmeyer, A. Steele, J. Toporski, I. Beech, **F. Terán Arce**, B. Spangler, K. Cole, D. S. McKay. "A comparison of antibody-antigen interactions on collagen measured by conventional immunological techniques and atomic force microscopy". *Langmuir* 20, 11053-11063 (2004).
11. **F. Terán Arce**, R. Avci, I. B. Beech, K. E. Cooksey, B. Wigglesworth-Cooksey. "A live bioprobe for studying diatom-surface interactions". *Biophys. J.* 87, 4284-4297 (2004).
12. R. Avci, M. H. Schweitzer, R. D. Boyd, J. L. Wittmeyer, **F. Terán Arce**, J. O. Calvo. "Preservation of bone collagen from the late Cretaceous period, studied by immunological and atomic force microscopy". *Langmuir* 21, 3584-3590, (2005).
13. Z. Suo, **F. Terán Arce**, R. Avci, K. Thielges, B. Spangler. "Dendritic structures of poly(ethylene glycol) on silicon nitride and gold surfaces". *Langmuir* 22, 3844-3850 (2006).
14. P. A. Suci, M. T. Klem, **F. T. Arce**, T. Douglas, M. Young. "Assembly of multilayer films incorporating a viral protein cage architecture". *Langmuir* 22, 8891-8896 (2006).
15. **F. Terán Arce**, R. Avci, I. B. Beech, K. E. Cooksey, B. Wigglesworth-Cooksey. "Modification of surface properties of a polydimethylsiloxane based elastomer, RTV11, under the influence of seawater". *Langmuir* 22, 7217-7225 (2006).
16. F. Liu\*, **F. Terán Arce**\*, S. Ramachandran\*, R. Lal. "Nanomechanics of hemichannel conformations: connexin flexibility underlying channel opening and closing". *J Biol. Chem.* 281, 23207-23217 (2006).  
**\*Equal first author.**
17. M. Higby Schweitzer, Z. Suo, R. Avci, J. M. Asara, M. A. Allen, **F. Teran Arce**, J. R. Horner. "Analyses of soft tissue from tyrannosaurus rex Suggest the presence of protein". *Science* 316, 277-280 (2007).
18. **F. Terán Arce**, J. L. Whitlock, A. A. Birukova, K. G. Birukov, M. F. Arnsdorf, J.G.N. García, R. Lal and S. Dudek. "Micromechanical properties of pulmonary endothelial barrier enhancement induced by sphingosine-1 phosphate: regulation by cortactin". *Biophys. J* 95, 886-894 (2008).
19. P. Landon, J. J. Gutierrez, S. A. Alvarado, S. Peela, S. Ramachandran, **F. Teran Arce**, R. Lal. "Hollow disc and sphere shaped particles from red Blood cell templates". *Research Letters in Physical Chemistry*, volume 2008, Article ID 726285 (2008). <http://dx.doi.org/10.1155/2008/726285>.
20. A. A. Birukova\*, **F. Terán Arce**\*, N. Moldobaeva, S. Dudek, J.G.N. García, R. Lal, K. G. Birukov. "Endothelial permeability is controlled by spatially defined cytoskeletal force distribution: application of atomic force microscopy". *Nanomed.-Nanotechnol.* 5, 30-41 (2009). **\*Equal first author.**
21. **F. Terán Arce**, R. Carlson, J. Monds, R. Veeh, F. Z. Hu, P. S. Stewart, R. Lal, G. D. Ehrlich, R. Avci. "Nanoscale structural and mechanical properties that influence pathogenicity of *Haemophilus influenzae* biofilms". *J. Bacteriol.* 191, 2512-2520 (2009).
22. H. Jang, **F. Teran Arce**, R. Capone, S. Ramachandran, R. Lal, R. Nussinov. "Misfolded amyloid ion channels present mobile  $\beta$ -sheet subunits in contrast to conventional ion channels". *Biophys. J.* 97, 3029-3037 (2009).

23. M. Mustata, R. Capone, H. Jang, **F. Teran Arce**, S. Ramachandran, R. Lal, R. Nussinov. "The K3 Fragment of amyloidogenic  $\beta$ 2-microglobulin forms ion channels: implication for dialysis related amyloidosis". *J. Am. Chem. Soc.* 131 (41), 14938–14945 (2009).
24. R. Capone, M. Mustata, H. Jang, **F. Teran Arce**, R. Nussinov, R. Lal. Antimicrobial protegrin-1 forms ion channels: molecular dynamic simulation, atomic force microscopy, and electrical conductance studies, *Biophys. J.* 98, 2644-2652 (2010).
25. H. Jang, **F. Teran Arce**, S. Ramachandran, R. Capone, R. Lal, R. Nussinov. "Structural convergence among diverse, toxic  $\beta$ -Sheet ion channels". *J. Phys. Chem. B* 114, 9445-9451 (2010).
26. H. Jang\*, **F. Teran Arce\***, S. Ramachandran\*, R. Capone, R. Azimova, B. L. Kagan, R. Nussinov, R. Lal. "Truncated  $\beta$ -amyloid peptide channels provide an alternative mechanism for Alzheimer's Disease and Down syndrome". *Proc. Natl. Acad. Sci. U.S.A.* 107, 6538-6543 (2010). **\*Equal first author.**
27. S. M. Dudek, E. T. Chiang, S. M. Camp, Y. Guo, J. Zhao, M. E. Brown, P. A. Singleton, L. Wang, A. Desai, **F. Teran Arce**, R. Lal, J. E. Van Eyk, S. Z. Imam, J. G. N. Garcia. "Abl tyrosine kinase phosphorylates non-muscle myosin light chain kinase to regulate endothelial barrier function". *Mol. Biol. Cell* 21, 4042–4056 (2010).
28. H. Jang, **F. Teran Arce**, S. Ramachandran, R. Capone, R. Lal, R. Nussinov. " $\beta$ -Barrel topology of Alzheimer's  $\beta$ -Amyloid ion channels". *J. Mol. Biol.* 404, 917-934 (2010).
29. R. Ayala, C. Zhang, D. Yang, A. Aung, S. Shroff, **Fernando T. Arce**, Y.S. Hwang, R. Lal, G. Arya, S. Varghese. Engineering cell-material interface for controlling stem cell adhesion, migration, and differentiation. *Biomaterials* 32, 3700-3711 (2011).
30. S. Ramachandran, **F. Teran Arce**, R. Lal. " Potential role of atomic force microscopy in systems biology". *Wiley Interdisciplinary Reviews: Systems Biology and Medicine* 3, 702-716 (2011).
31. H. Jang\*, **F. Teran Arce\***, M. Mustata\*, S. Ramachandran, R. Capone, R. Nussinov, R. Lal. "Antimicrobial Protegrin-1 forms amyloid-like fibrils with rapid kinetics suggesting a functional link". *Biophys. J.* 100, 1775-1783 (2011). **(featured as new and notable) \*Equal first author.**
32. **F. Teran Arce**, Hyunbum Jang, Srinivasan Ramachandran, Preston B. Landon, Ruth Nussinov and Ratnesh Lal. "Polymorphism of amyloid  $\beta$  peptide in different environments: implications for membrane insertion and pore formation". *Soft Matter* 7, 5267-5273 (2011).
33. B. L. Kagan, H. Jang, R. Capone, **F. Teran Arce**, S. Ramachandran, R. Lal and R. Nussinov "Antimicrobial properties of amyloid peptides". *Mol. Pharmaceutics* 9(4), 708–717 (2012).
34. R. Capone, H. Jang, S. Kotler, L Connelly, **F. Teran Arce**, S. Ramachandran, B. L. Kagan, R. Nussinov, R. Lal. "All-D-enantiomer of  $\beta$ -amyloid peptide forms ion channels in lipid bilayers". *J. Chem. Theory Comput.* 8(3), 1143–1152 (2012).
35. L. Connelly, H. Jang, **F. Teran Arce**, R Capone, S. A. Kotler, S Ramachandran, B. L. Kagan, R. Nussinov and R. Lal. "Atomic force microscopy and MD simulations reveal pore-like structures of all-D-enantiomer of Alzheimer's  $\beta$ -amyloid peptide: relevance to the ion channel mechanism of AD pathology" *J. Phys. Chem. B* 116, 1728–1735 (2012).

36. L. Connelly, H. Jang, **F. Teran Arce**, S. Ramachandran, B. L. Kagan, R. Nussinov and R. Lal. "Effects of point substitutions on the structure of toxic Alzheimer's  $\beta$ -amyloid channels: atomic force microscopy and molecular dynamics simulations" *Biochemistry* 51(14), 3031–3038 (2012).
37. H. Jang, L. Connelly, **F. Teran Arce**, S. Ramachandran, B. L. Kagan, R. Lal, and R. Nussinov. "Mechanisms for the insertion of toxic, fibril-like beta-amyloid oligomers into the membrane" *J. Chem. Theory Comput.* 9(1), 822–833 (2013).
38. H. Jang, L. Connelly, **F. Terán Arce**, S. Ramachandran, B. L. Kagan, R. Lal, and R. Nussinov. "Alzheimer's disease: which type of amyloid-preventing drug agents to employ?" *Phys. Chem. Chem. Phys.* 15(23), 8868-8877 (2013).
39. H. Jang, **F. Terán Arce**, S. Ramachandran, B. L. Kagan, R. Lal, and R. Nussinov. "Familial Alzheimer's disease Osaka mutant ( $\Delta E22$ )  $\beta$ -barrels suggest an explanation for the different  $A\beta_{1-40/42}$  preferred conformational states observed by experiment" *J. Phys. Chem. B* 117 (39), 11518–11529 (2013).
40. **F. Terán Arce**, B. Meckes, S. M. Camp, J. G. Garcia, S. M. Dudek, R. Lal. "Heterogeneous elastic response of human lung microvascular endothelial cells to barrier modulating stimuli" *Nanomed.-Nanotechnol.* 9 (7), 875-884 (2013).
41. H. Jang, **F. Teran Arce**, S. Ramachandran, B. L. Kagan, R. Lal, and R. Nussinov. "Disordered amyloidogenic peptides may insert into the membrane and assemble into common cyclic structural motifs". *Chem. Soc. Rev.*, 43(19):6750-64 (2014).
42. B. Meckes, **F. Terán Arce**, L. Connelly and R. Lal. "Insulated conducting cantilevered nanotips and two-chamber recording system for high resolution ion sensing AFM". *Sci. Rep.*, 4, 4454 (2014).
43. S. Ramachandran\*, **F. Terán Arce\***, Patel, N., Quist, A. P., Cohen, D. A., and R. Lal. "Structure and permeability of ion-channels by integrated AFM and waveguide TIRF microscopy" *Sci. Rep.*, 4, 4424 (2014). **\*Equal first author.**
44. J. Kwok, S. Grogan, B. Meckes, **F. Arce**, R. Lal, and D. D'Lima "Atomic force microscopy reveals age-dependent changes in nanomechanical properties of the extracellular matrix of native human menisci: implications for joint degeneration and osteoarthritis." *Nanomed.-Nanotechnol.*, 10(8), 1777–1785 (2014).
45. B. Meckes, C. Ambrosi, H. Barnard, **F. Terán Arce**, G. Sosinsky and R. Lal. "Atomic force microscopy shows connexin26 hemichannel clustering in purified membrane fragments". *Biochemistry* 53(47),7407-14 (2014).
46. A.L. Gillman, H. Jang, J. Lee, S. Ramachandran, B. L. Kagan, R. Nussinov and **F. Terán Arce**. "Activity and architecture of pyroglutamate modified amyloid- $\beta$  ( $A\beta_{pE3-42}$ ) pores". *J. Phys. Chem. B.* 118 (26), 7335–7344 (2014).
47. J. Lee, A.L. Gillman, H. Jang, S. Ramachandran, B. L. Kagan, R. Nussinov and **F. Terán Arce**. "Role of fast kinetics of pyroglutamate modified amyloid- $\beta$  oligomers in membrane binding and membrane permeability". *Biochemistry* 53 (28), 4704–4714 (2014).
48. K. Santacruz-Gomez, E. Silva-Campa, R. Melendrez-Amavizca, **F. Teran Arce**, V. Mata-Haro, P. B. Landon, C. Zhang, M. Pedroza-Montero and R. Lal. "Carboxylated nanodiamonds inhibit  $\gamma$ -irradiation damage of human red blood cells". *Nanoscale* 8, 7189 (2016).

49. Q. Huang, **F. Teran Arce**, J. Lee, I. Yoon, R. Lal, D. J. Sirbuly. "Single nanoparticle terminated AFM tips to study the optical interaction between plasmonic nanoparticles with dielectric waveguide". *Nanoscale* 8, 17102-17107 (2016).
50. J. Lee\*, Y. H. Kim\*, **Fernando T. Arce\***, A. L. Gillman, H. Jang, B. L. Kagan, R. Nussinov, J. Yang, and R. Lal. "Amyloid  $\beta$  Ion Channels in a Membrane Comprising Brain Total Lipid Extracts". *ACS Chem. Neurosci.* 8, 1348–1357 (2017). **\*Equal contributor.**
51. Q. Huang\*, J. Lee\*, **F. Teran Arce\***, I. Yoon, P. Angsantikul, J. Liu, Y. Shi, J. Villanueva, S. Thamphiwatana, X. Ma, Liangfang Zhang, S. Chen, R. Lal, and D. J. Sirbuly. "Nanofibre optic force transducers with sub-piconewton resolution via near-field plasmon-dielectric interactions" *Nature Photonics* 11, 352–355 (2017). **\*Equal contributor.**
52. A. Hernandez Martinez, Hendrik Urbanke, A. Gillman, J. Lee, S. Ryazanov, H. Y. Agbemenyah, E. Benito, G. Jain, L. Kaurani, G. Grigorian, A. Leonov, N. Rezaei-Ghaleh, P. Wilken, **F. Teran Arce**, J. Wagner, M. Fuhrman, M. Caruana, A. Camilleri, N. Vasallo, M. Zweckstetter, R. Benz, A. Giese, A. Schneider, M. Korte, R. Lal, C. Griesinger, G. Eichele, Andre Fischer " The diphenylpyrazol compound anle138b blocks A $\beta$  channels and rescues disease phenotypes in a mouse model for amyloid pathology". *EMBO Mol. Medicine* (2017, accepted).

## Current Lab members

Scott Younger: M.S. Student (Biomedical Engineering)

Lane Breshears: Undergraduate student (Biomedical Engineering)