**Pedro Antonio Valdes Hernandez, Ph.D.**

# Contact information

Research Assistant Professor, Community Dentistry & Behavioral Science (CDBS), College of Dentistry,

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Google Scholar: <https://scholar.google.com/citations?view_op=list_works&hl=en&user=UbLgLucAAAAJ>

Scopus: <https://www.scopus.com/authid/detail.uri?authorId=16507926800>

PubMed: <https://pubmed.ncbi.nlm.nih.gov/?term=valdes-hernandez+p>

ResearchGate: <https://www.researchgate.net/profile/Pedro_Valdes-Hernandez>

Frontiers: <http://loop.frontiersin.org/people/31341/overview>

# Education

2016 PhD. in Physics, University of Havana, Cuba

*Thesis:* Optimizing individual accuracy of Brain Electrical Tomography using Computational Neuroanatomy. *Supervisors:* Prof. Pedro A. Valdés-Sosa (Cuban Neuroscience Center) and Assoc. Prof. Jorge J. Riera (Florida International University)

2001 BSc. in Nuclear Physics, Superior Institute of Nuclear Science and Technology, Havana, Cuba

*Thesis:* Water diffusion neuroimaging. *Supervisor:* Prof. Pedro A. Valdés-Sosa (Cuban Neuroscience Center)

# Professional statement and interests

**I am a neuroscientist, dedicated to the use of quantitative methods (with an emphasis on Artificial Intelligence) and biostatistics for neuroimaging research on chronic pain, aging, and related behavior.** Always with a mindset on clinical applications, my research interests follow a two-pronged approach. The first one is related to my **NIH/NIA Career Development (K01) grant, which scored a 17 on October 2023*—***very likely to be funded since the last pay-line was 241 and has not gone below 20 since 2017, and NIA is known to abide by the score when considering what proposal is going to be funded. The grant proposes the use of novel deep learning brain age biomarkers to classify different chronic pain types, and it is supported by mentors with very strong expertise in Artificial Intelligence (AI) (Dr. Mattia Prosperi, Dr. Qing Lu, at UF, and Dr. James Cole at UCL) and pain (Dr. Cruz-Almeida and Dr. Fillingim at UF). It leverages the availability of tens of thousands of MRIs from the UK Biobank and the powerful resources available through the UF’s AI initiative. The second branch of my research interests is related to the understanding of behavior and mental states from a neurobiological, mechanistic perspective. Specifically, I want to model the brain as a state-space system, where the hidden states are driven by nonlinear equations parameterized by artificial neural networks, and the observations are EEG and fMRI. This is also a mediation model where the brain mediates the causal relationship between stimuli and behavior. I plan to apply this modeling to data obtained during simultaneous EEG/fMRI recordings while subjects (either humans or rats) receive painful stimuli and react to it (e.g., by continuously rating their pain in the case of humans). I will be able to carry out through several funding mechanisms leveraging the diverse portfolio of expertise that I have acquired throughout my career:

* Biostatistics, e.g., multivariate regression, machine learning algorithms, signal processing and inference.
* AI and Statistical Learning, i.e., support vector machines, deep learning, convolutional neural networks applied to development of biomarkers.
* Medical Image Analysis/Computational Neuroanatomy, e.g., brain morphometry, tractography, tissue segmentation and classification, image visualization.
* Computational Neurosciences, e.g., modelling of brain dynamics.
* Biophysical Modelling of the Brain (human, monkey, and rat), i.e., modelling the underlying biophysical mechanisms and signal formation of EEG/MEG and BOLD fMRI
* Human and rat experimentation, e.g., behavioral fMRI experiments, pain fMRI experiments and EEG in Epilepsy.
* Programming skills in MATLAB and Python.

I also have experience teaching and mentoring, and I love it. I gave lectures in my alma mater on MRI principles and Computational Neurosciences and assisted in teaching Neuroinformatics tools to undergraduate students at FIU and I have mentored several bachelor and master theses.

# Publications

<https://scholar.google.com/citations?user=UbLgLucAAAAJ&hl=en> h-index=13, h10-index=16, 1407 citations

***\*Equal contribution with first author (shared leading role in the publication)***

## Peer reviewed:

1. **Valdes-Hernandez, P.A.**, Laffitte Nodarse, Peraza, J., Cole, J.H., Cruz-Almeida, Y. (2023). Toward MR protocol-agnostic, bias-corrected brain age predicted from clinical-grade MRIs. *Scientific Reports* 13, 19570. <https://doi.org/10.1038/s41598-023-47021-y>
2. **Valdes-Hernandez, P.A.**, Laffitte Nodarse, C., James Cole, Cole, J.H., Cruz-Almeida, Y. (2023). Feasibility of brain age predictions from clinical MRIs. *Brain Research Bulletin* 110811 (in press). <https://doi.org/10.1016/j.brainresbull.2023.110811>
3. **Valdes-Hernandez, P.A.**, Johnson A.J., Montesino-Goicolea, S., Laffitte Nodarse, C., Bashyam, V., Davatzikos, Fillingim, R.B, Cruz-Almeida, Y. (2023). Accelerated brain aging mediates the association between psychological profiles and clinical pain in knee osteoarthritis. *The Journal of Pain* (n press). <https://doi.org/10.1016/j.jpain.2023.11.006>
4. Montesino-Goicolea, S., **Valdes-Hernandez, P.A**, Laffitte Nodarse, C., Johnson, J.J, Cole, J.H., Antoine L.H., Goodin B.R., Fillingim, R.B, Cruz-Almeida, Y. (2023) Brain-predicted age difference mediates the association between PROMIS sleep impairment, and self-reported pain measure in persons with knee pain. *Aging Brain* 4, 100088. <https://doi.org/10.1016/j.nbas.2023.100088>
5. **Valdes-Hernandez, P.A.\***, Laffitte Nodarse, C.\*, Johnson A.J., Montesino-Goicolea, S., Bashyam, V., Davatzikos, C., Peraza, J.A, Cole, J.H., Huo Z., Fillingim, R.B, Cruz-Almeida, Y. (2023). Brain predicted age difference estimated using DeepBrainNet is significantly associated with pain and function—a multi-institutional and multi-scanner study. *PAIN.* <https://doi.org/10.1097/j.pain.0000000000002984>
6. Montesino-Goicolea, S., Nin, O., Gonzalez, B.M., Sawczuk, N.J., Laffitte Nodarse, C., **Valdes-Hernandez, P.A.**, Jackson, E., Huo, Z., Somerville, J.E.T., Porges, E.C., Smith, C., Fillingim, R.B, Cruz-Almeida, Y. (2023). Protocol for a pilot and feasibility randomized-controlled trial of four weeks of oral γ-aminobutyric acid (GABA) intake and its effect on pain and sleep in middle-to-older aged adults. *Contemporary Clinical Trials Communications*, 32, 101066. <https://doi.org/10.1016/j.conctc.2023.101066>
7. Johnson, A.J., Buchanan, T., Laffitte Nodarse, C., **Valdes-Hernandez, P.A.**, Huo, Z., Cole, J.H., Buford, T.W., Fillingim, R.B., Cruz-Almeida, Y. (2022) Cross-Sectional Brain-Predicted Age Differences in Community-Dwelling Middle-Aged and Older Adults with High Impact Knee Pain. *Journal of Pain Research*, 15, 3575-3587. <https://doi.org/10.2147/JPR.S384229>
8. Strath, L., **Valdes-Hernandez, P.A**, Laffitte, Nodarse C., Johnson, A.J., Edberg, J., Fillingim, R.B., & Cruz-Almeida Y. (2022). Clinical Vitamin D Levels are Associated with Insular Volume and Inferior Temporal Gyrus White Matter Surface Area in Community-Dwelling Individuals with Knee Pain. *Frontiers in Neuroscience,* 16, 882322. <https://doi.org/10.3389/fnins.2022.882322>
9. Montesino-Goicolea, S., **Valdes-Hernandez, P.A\***, R., Cruz-Almeida, Y. (2022) Chronic Musculoskeletal Pain Moderates the Association between Sleep Quality and Dorsostriatal-Sensorimotor Resting State Functional Connectivity in Community-Dwelling Older Adults. *Pain Research and Management*, 2022, 1-12. <https://doi.org/10.1155/2022/4347759>
10. Johnson, A.J., Laffitte, Nodarse C., Peraza, J. A., **Valdes-Hernandez, P.A.**, Montesino-Goicolea, S., Huo Z., Fillingim, R.B., & Cruz-Almeida Y. (2021). Psychological profiles in adults with knee OA-related pain: A replication study. *Therapeutic Advances in Musculoskeletal Disorders*, 13, 1759720X211059614. <https://doi.org/10.1177/1759720X211059614>
11. **Valdes-Hernandez, P.A.**, Montesino-Goicolea, S., B. Fillingim, R.B., Riley III, J.L., Porges, E., Woods, A., Cohen, R., & Cruz-Almeida, Y. (2021). Resting state functional connectivity is associated with chronic pain duration in community-dwelling older adults. *Pain Reports*, 6(4), e978. <https://doi.org/10.1097/PR9.0000000000000978>
12. Suarez, A., **Valdes-Hernandez, P.A**.**\***, Bernal, B., Dunoyer, C., Bosch-Bayard, J., & Riera, J. J. (2021). Identification of Negative BOLD Responses in Epilepsy using Windkessel Models. *Frontiers in Neurology*, 12, 1735. <https://www.frontiersin.org/articles/10.3389/fneur.2021.659081/abstract> *(for original idea, see bioRxiv below)*
13. **Valdes-Hernandez, P. A.**, Polk, R., Horta, M., Frazier, I., Perez, E., Ojeda, M., Porges, E., Cruz-Almeida, Y., Feifel, D., & Ebner, N. C. (2021). Chronic oxytocin administration in older men modulates functional connectivity during animacy perception. *Aging Brain*, 1, 100023. <https://doi.org/10.1016/j.nbas.2021.100023>
14. Yeater, T. D., Clark, D. J., Hoyos, L., **Valdes-Hernandez, P. A.**, Peraza, J. A., Allen, K. D., & Cruz-Almeida, Y. (2021). Chronic Pain is Associated with Reduced Sympathetic Nervous System Reactivity during Simple and Complex Walking Tasks: Potential Cerebral Mechanisms. *Chronic Stress*, 5, 1–8. <https://doi.org/10.1177/24705470211030273>
15. Suarez, A., **Valdes-Hernandez, P. A.**, Moshkforoush, A., Tsoukias, N., & Riera, J. (2021). Arterial blood stealing as a mechanism of negative BOLD response: From the steady-flow with nonlinear phase separation to a windkessel-based model. *Journal of Theoretical Biology*, 529, 110856. <https://doi.org/10.1016/j.jtbi.2021.110856>
16. Johnson, A. J., Wilson, A. T., Laffitte Nodarse, C., Montesino-Goicolea, S., **Valdes-Hernandez, P. A.**, Somerville, J., Peraza, J. A., Fillingim, R. B., Bialosky, J., & Cruz-Almeida, Y. (2021). Age Differences in Multi-modal Quantitative Sensory Testing and Associations with Brain Volume. *Innovation in Aging*, 5(3), 1–14. <https://doi.org/10.1093/geroni/igab033>
17. Montesino-Goicolea, S., **Valdes-Hernandez, P. A.**, Hoyos, L., Woods, A. J., Cohen, R., Huo, Z., Riley, J. L., Porges, E. C., Fillingim, R. B., & Cruz-Almeida, Y. (2020). Cortical thickness mediates the association between self-reported pain and sleep quality in community-dwelling older adults. *Journal of Pain Research*, 13, 2389–2400. <https://doi.org/10.2147/JPR.S260611>
18. Peraza-Goicolea, J. A., Martínez-Montes, E., Aubert, E., **Valdés-Hernández, P. A.**, & Mulet, R. (2020). Modeling functional resting-state brain networks through neural message passing on the human connectome. *Neural Networks*, 123, 52–69. <https://doi.org/10.1016/j.neunet.2019.11.014>
19. Bernal, B., Guillen, M. R., **Valdes, P.**, Jayakar, P., Altman, N., Duchowny, M., & Riera, J. (2019). Epilepsy Focus Localization in Patients Utilizing BOLD Differences Related to Regional Metabolic Dynamics. *Open Journal of Radiology*, 09(03), 163–175. <https://doi.org/10.4236/ojrad.2019.93015>
20. Todaro, C., Marzetti, L., Valdés Sosa, P. A., **Valdés-Hernandez, P. A.**, & Pizzella, V. (2019). Mapping Brain Activity with Electrocorticography: Resolution Properties and Robustness of Inverse Solutions. *Brain Topography*, 32(4), 583–598. <https://doi.org/10.1007/s10548-018-0623-1>
21. **Valdés-Hernández, P. A.**, Bae, J., Song, Y., Sumiyoshi, A., Aubert-Vázquez, E., & Riera, J. J. (2019). Validating Non-invasive EEG Source Imaging Using Optimal Electrode Configurations on a Representative Rat Head Model. *Brain Topography*, 32(4), 599–624. <https://doi.org/10.1007/s10548-016-0484-4>
22. Wang, Q., **Valdés-Hernández, P. A.\***, Paz-Linares, D., Bosch-Bayard, J., Oosugi, N., Komatsu, M., Fujii, N., & Valdés-Sosa, P. A. (2019). EECoG-Comp: An Open-Source Platform for Concurrent EEG/ECoG Comparisons—Applications to Connectivity Studies. *Brain Topography*, 32(4), 550–568. <https://doi.org/10.1007/s10548-019-00708-w>
23. Deshmukh, A., Leichner, J., Bae, J., Song, Y., **Valdés-Hernández, P. A.**, Lin, W.-C., & Riera, J. J. (2018). Histological Characterization of the Irritative Zones in Focal Cortical Dysplasia Using a Preclinical Rat Model. *Frontiers in Cellular Neuroscience*, 12, 52. <https://doi.org/10.3389/fncel.2018.00052>
24. Moshkforoush, A., **Valdes-Hernandez, P. A.\***, Rivera-Espada, D. E., Mori, Y., & Riera, J. (2018). waveCSD: A method for estimating transmembrane currents originated from propagating neuronal activity in the neocortex: Application to study cortical spreading depression. *Journal of Neuroscience Methods*, 307(January), 106–124. <https://doi.org/10.1016/j.jneumeth.2018.06.024>
25. Paz-Linares, D., Vega-Hernández, M., Rojas-López, P. A., **Valdés-Hernández, P. A.**, Martínez-Montes, E., & Valdés-Sosa, P. A. (2017). Spatio Temporal EEG Source Imaging with the Hierarchical Bayesian Elastic Net and Elitist Lasso Models. *Frontiers in Neuroscience*, 11(NOV), 1-22. <https://doi.org/10.3389/fnins.2017.00635>
26. Karahan, E., Rojas-Lopez, P. A., Bringas-Vega, M. L., **Valdes-Hernandez, P. A.**, & Valdes-Sosa, P. A. (2015). Tensor Analysis and Fusion of Multimodal Brain Images. Proceedings of the IEEE, 103(9), 1531–1559. <https://doi.org/10.1109/JPROC.2015.2455028>
27. Iturria-Medina, Yasser, Pérez Fernández, A., **Valdés Hernández, P.**, García Pentón, L., Canales-Rodríguez, E. J., Melie-Garcia, L., Lage Castellanos, A., Ontivero Ortega, M., Perez Fernandez, A., Valdes Hernandez, P., Garcia Penton, L., Canales-Rodriguez, E. J., Melie-Garcia, L., Castellanos, A. L., & Ortega, M. O. (2011). Automated discrimination of brain pathological state attending to complex structural brain network properties: the shiverer mutant mouse case. *PLoS One*, 6(5), e19071. <https://doi.org/10.1371/journal.pone.0019071>
28. **Valdés-Hernández, P. A.\***, Sumiyoshi, A.\*, Nonaka, H., Haga, R., Aubert-Vázquez, E., Ogawa, T., Iturria-Medina, Y., Riera, J. J., & Kawashima, R. (2011). An in vivo MRI template set for morphometry, tissue segmentation, and fMRI localization in rats. Frontiers in *Neuroinformatics*, 5(26), 1. <https://doi.org/10.3389/fninf.2011.00026>
29. Valdés-Sosa, M., Bobes, M. A., Quiñones, I., Garcia, L., **Valdes-Hernandez, P. A.**, Iturria, Y., Melie-Garcia, L., Lopera, F., & Asencio, J. (2011). Covert face recognition without the fusiform-temporal pathways. *NeuroImage*, 57(3), 1162–1176. <https://doi.org/10.1016/j.neuroimage.2011.04.057>
30. **Valdés-Hernández, P. A.**, Ojeda-González, A., Martínez-Montes, E., Lage-Castellanos, A., Virués-Alba, T., Valdés-Urrutia, L., & Valdes-Sosa, P. A. (2010). White matter architecture rather than cortical surface area correlates with the EEG alpha rhythm. *NeuroImage*, 49(3), 2328–2339. <https://doi.org/10.1016/j.neuroimage.2009.10.030>
31. Uludağ, K., Evans, A. C., Della-Maggiore, V., Kochen, S., Amaro, E., Sierra, O., **Valdés-Hernandez, P.**, Medina, V., & Valdés-Sosa, P. (2009). Latin American Brain Mapping Network (LABMAN). *NeuroImage*, 47(1), 312–313. <https://doi.org/10.1016/j.neuroimage.2009.03.030>
32. **Valdés-Hernández, P. A.**, von Ellenrieder, N., Ojeda-Gonzalez, A., Kochen, S., Alemán-Gómez, Y., Muravchik, C., & Valdés-Sosa, P. A. (2009). Approximate average head models for EEG source imaging. *Journal of Neuroscience Methods*, 185(1), 125–132. <https://doi.org/10.1016/j.jneumeth.2009.09.005>
33. von Ellenrieder, N., **Valdés-Hernández, P. A.**, & Muravchik, C. H. (2009). On the EEG/MEG forward problem solution for distributed cortical sources. *Medical & Biological Engineering & Computing*, 47(10), 1083–1091. <https://doi.org/10.1007/s11517-009-0529-x>
34. Uludağ, K., Evans, A., Murer, G., Amaro, E., Sierra, O., Valdes-Hernandez, P. A., Medina, V., & Valdes-Sosa, P. A. (2008). Latin American Brain Mapping Network. *International Journal of Bioelectromagnetism*, 10(4), 281–299. <http://www.ijbem.org/volume10/number4/281-299.pdf>
35. Melie-García, L., Canales-Rodríguez, E. J., Alemán-Gómez, Y., Lin, C. P., Iturria-Medina, Y., & **Valdés-Hernández, P. A.** (2008). A Bayesian framework to identify principal intravoxel diffusion profiles based on diffusion-weighted MR imaging. *NeuroImage*, 42(2), 750–770. <https://doi.org/10.1016/j.neuroimage.2008.04.242>
36. Iturria-Medina, Y., Canales-Rodríguez, E. J., Melie-García, L., **Valdés-Hernández, P. A.**, Martínez-Montes, E., Alemán-Gómez, Y., & Sánchez-Bornot, J. M. (2007). Characterizing brain anatomical connections using diffusion weighted MRI and graph theory. *NeuroImage*, 36(3), 645–660. <https://doi.org/10.1016/j.neuroimage.2007.02.012>
37. Iturria-Medina, Yasser, & **Valdes-Hernandez, P. A.** (2006). De las Neuroimágenes a la Conectividad Anatómica Cerebral (From Neuroimaging to Brain Anatomical Connectivity). *CENIC Ciencias Biologicas*, 37(4), 307–315.
38. **Valdés-Hernández, P. A.,** & Iturria-Medina, Y. (2006). Imágenes de Tensores de Difusión y sus Aplicaciones (Diffusion Tensor Imaging and its Applications). *CENIC Ciencias Biologicas*, 37(4), 262.

## Selected not peer-reviewed:

1. **Valdés-Hernández, P. A.**, Bernal, Byron, Moshkforoush, Arash, Dunoyer, Catalina, Khoo, Hui Ming, Bosch-Bayard, Jorge, von-Ellenrieder, Nicolas, Gotman, Jean, & Riera, Jorge J. (2018). Identification of negative BOLD responses using windkessel models. *bioRxiv* 392290; doi: <https://doi.org/10.1101/392290>
2. **Valdés-Hernández, P. A.**, & Knoesche, T. (2016). Initial conditions in the neural field model. *arXiv: Neurons and Cognition*: n. pag. <https://arxiv.org/ftp/arxiv/papers/1605/1605.07074.pdf>

# Work History

## 2023-present: Research Assistant Professor

***University of Florida, Gainesville, FL, USA***

* Adapted brain age biomarkers for multimodal clinical MRI data from the UFHealth System.
* Applied deep learning to develop brain age biomarkers to classify pain types.
* Studied the relation between psychological profiles and brain aging in knee pain.
* Examined the effects of pain on the neurobiological mechanisms of interoception.
* Conducted statistical analysis of fMRI and structural MRI data.
* Conducted MRI experiments at the McKnight Brain institute at the University of Florida.

## 2022-2023: Research Assistant Professor

***University of Florida, Gainesville, FL, USA***

* Designed MRI protocols for, and acquired and analyzed, MRI data from rats with knee osteoarthritis.
* Studied the effects of differential effects of several chronic pain types on brain aging.
* Conducted statistical analysis of fMRI and structural MRI data.
* Conducted MRI experiments on humans at the McKnight Brain institute at the University of Florida.
* Supervised undergraduate and postdoctoral students.

## 2018-2020: NIH/NIA T32 Postdoctoral Fellow

***University of Florida, Gainesville, FL, USA***

* Acquired data for my NIH funded project on the underlying mechanisms of pain perception and modulation.
* Implemented a conditioned-pain-modulation protocol in the MRI scanner with continuous pain ratings.
* Designed MRI protocols for an NIH study on the effects of oxytocin on older adults.
* Implemented an interoception paradigm using EPRIME combined with pain stimulation with continuous pain ratings.
* Conducted statistical analysis of fMRI and structural MRI data of older adults with chronic pain and sleep problems.
* Studied the effects of 4-week chronic oxytocin administration on fMRI connectivity of older adults during an animacy perception social task.

## 2016-2018: Postdoctoral Associate

***Florida International University, Miami, FL, USA***

* Developed a computational physics model to map neural activity, as measured using Current Source Densities (CSD), to EEG/MEG signals, based on solving Maxwell equations using multipolar expansions.
* Developed computational physics models of the propagation of cortical CSD waves in the rat cortex.
* Developed EEG forward FEM and BEM models based on realistically shaped head models of monkeys.
* Developed biophysical models, solving stochastic ODE equations, of mechanisms of negative BOLD responses. Applied machine learning methods to classify the BOLD responses in Epilepsy.
* Developed hardware for BrainVision, specifically EEG min-caps for rats. Assisted investigators of this product in several universities in the use of EEG mini-cap and signal processing.
* Conducted research (i.e., measured, preprocessed, and analyzed data) on EEG-fMRI in epilepsy, in both children (Nicklaus Children Hospital) and rats (9.4 T scanner at Yale University).
* Trained in rat experimentation of EEG-fMRI, LFP, Doppler and optical imaging, and its related signal processing and data analysis algorithms.
* Served as a teaching instructor of several courses on MRI physics and sequence design, and the use of neuroimaging tools (fMRI, Morphometry and EEG/MEG).
* Supervised several undergraduate students.

## 2014-2016: Researcher

***Cuban Neuroscience Center, Havana, Cuba***

* Finished my Ph.D.
* Conducted EEG/MEG forward and inverse modelling in both humans and rats.
* Applied Bayesian statistical methods on MRI databases to propose approximate forward EEG/MEG models.
* Modeled non-linear systems and bifurcation analysis.
* Supervised the installation of a 3T scanner in the new the Human Brain Mapping Unit at the Cuban Neuroscience Center. I also oversaw the maintenance of the equipment, provided expertise, trained, and supported non-technical staff in the operation of the system, proposed new MRI projects and protocols.
* Performed MRI experiments in a 7T Bruker scanner and data analysis on rats at Tohoku University, Sendai Japan.
* As an invited lecturer, taught courses on MRI physics at the University of Havana.
* Supervised several undergraduate students.

## 2010-2014: Researcher and R&D project consultant

***Neuronic S.A (***[***www.neuronicsa.com***](http://www.neuronicsa.com)***) (spin-off of the Cuban Neuroscience Center), Havana, Cuba***

* Enrolled in my PhD program (2011).
* Conducted research on EEG and MRI with human and rat databases. Combining computational neuroanatomy and computational neuroscience
* Proposed surrogate EEG models based on statistical inference on head shape manifolds, exploiting large MRI databases.
* Tested specific predictions made by biophysical theories of the brain by combining multiple MRI modalities using multi-voxel pattern analysis.
* Developed and supervised several commercial software components dedicated to the analysis of MRI and EEG neuroimages.
* Supervised several diplomas and master thesis.

## 2005-2009: Responsible for the MRI Acquisition and data processing of the Cuban Human Brain Mapping Project

***Cuban Neuroscience Center, Havana, Cuba***

* Conducted research on the “neuroanatomical determinants of the EEG”, dedicated to testing predictions made by biophysical theories of the brain taking advantage of large multimodal MR databases.
* Coordinated the MRI studies of the Human Brain Project and Cuban Neuroscience Center. I performed protocol optimization and implementation of preprocessing tools.
* Trained in the design of MRI protocols and sequences at Siemens Medical Solutions headquarters in Erlangen Germany.
* Supervised several bachelor and master thesis.

## 2002-2004: Research Assistant at the Neuro-physics laboratory

***Cuban Neuroscience Center, Havana, Cuba***

* Developed diffusion MRI-based brain anatomical connectivity measures.
* Trained in the theory and processing of EEG, MRI, and Computational Neuroanatomy.

## Other Experience

* Visiting Researcher. University of Minnesota, Institute of Mathematics, Minnesota, USA (1 week)
* Visiting Researcher. Yale University, MRRC Preclinical scanners, Connecticut, USA (2017, 2 weeks)
* Visiting Researcher. Yale University, MRRC Preclinical scanners, Connecticut, USA (2016, 2 weeks)
* Visiting Researcher. Florida International University, Neuronal Mass Dynamics, Florida, USA (2015, 1 month)
* Visiting Researcher. Maastricht University, Faculty of Psychology and Neuroscience, Maastricht, The Netherlands (2014, 1 month)
* Visiting Researcher. Neural Mass Dynamic Laboratory of the Institute of Disease and Cancer, Sendai, Japan (2011, 4 months)
* Visiting Researcher. Neural Mass Dynamic Laboratory of the Institute of Disease and Cancer, Sendai, Japan (2010, 3 months)
* MRI Trainee. Siemens Medical Systems, Erlangen, Germany (2007, 2 weeks)
* Visiting Researcher. Laboratory of Industrial Electronics, Control and Instrumentation, National University of La Plata, La Plata, Argentina (2007, 3 months)
* Visiting Researcher. Montreal Neurological Institute (MNI), Montreal, Canada (2007, 3 months)
* MRI Trainee. University of Santiago de Cuba, Santiago de Cuba, Cuba (2001, 1 month)

# Teaching experience

Lecturer. MRI Principles and sequence Design. University of Havana (2008)

Lecturer. MRI Principles and sequence Design. University of Havana (2012)

Lecturer. Computational Neuroscience. University of Havana (2016)

Instructor. Tools for EEG/MEG and MRI processing and statistical analysis. Florida International University.

# Mentoring

1. B. Sc. in Physics. Thesis: Influence of noise on the multistability of a model of brain activity. Lázaro Miguel Sánchez-Rodríguez, Advisor: Pedro Antonio Valdés-Hernández. Havana University, Havana, Cuba, 2014
2. Thesis for obtaining the 1st degree specialization in Medicine in the Category of Immunology. Concentraciones de anticuerpos frente al toxoide diftérico y toxoide tetánico en niños asmáticos y no asmáticos, efecto del tabaquismo materno. Soamy Montesino Goicolea. 2010. Expert consultant: Pedro Antonio Valdés-Hernández
3. Thesis for obtaining the 1st degree specialization in Medicine in the Category of Immunology. Lactancia materna y respuesta humoral a vacunas de toxoide tetánico y diftérico en niños de 2 años. Deyanira La Rosa Hernández. 2010. Expert consultant in statistical analysis: Pedro Antonio Valdés-Hernández
4. M. Sc. in Neuroscience. Thesis: Structure Tensors for medical image registration: Application to automatic brain structures parcellation. Yasser Alemán-Gómez. Advisor: Pedro Antonio Valdés-Hernández. Cuban Neuroscience Center, Havana, Cuba, 2008
5. M. Sc. in Neuroscience. Thesis: Influence of local white matter architecture on alpha rhythm frequency. Alejandro Ojeda-González. Advisor: Pedro Antonio Valdés-Hernández. Cuban Neuroscience Center, Havana, Cuba, 2008
6. B. Sc. in Nuclear Engineering. Thesis: From Diffusion Neuroimaging to Brain Anatomical Connectivity. Yasser Iturria-Medina. Advisor: Pedro Antonio Valdés-Hernández. Higher Institute for Nuclear Science and Technology, Havana City, Cuba, 2003
7. B. Sc. in Physics. Thesis: Statistical Bayesian Model for the Characterization of Heterogeneity in Neural Fiber Distribution in the Human Brain. Erick Jorge Canales-Rodríguez. Advisors: Lester Melie-García and Pedro Antonio Valdés-Hernández. Physics Department, Havana University, 2002

# Track record of research funding

**FOA Title**: Research Supplements to Promote Diversity in Health-Related Research

Funder: NIA (Parent Grant P30AG028740-14)

Parent grant: University of Florida Claude D. Pepper Older Americans Independence Center (OAIC)

PI: Marco Pahor, MD. Institute on Aging

Period: 07/01/2020 - 03/31/2022

Value: $256,709

**Title**: Neurologic pain signatures in older adults with and without chronic pain

Funder: NIA Resource Center for Minority Aging Research (RCMAR) P30AG059297 and UF Center for Advancing Pain and Aging Science pilot

Period: 2019-2020

Role: Principal Investigator

Value: $25,000

# Main skills in programming and neuroinformatics software

## Languages (23 years of experience)

* MATLAB
* Python

## Software for biophysical modelling and processing of EEG/MEG signals

* SimBio (<https://www.mrt.uni-jena.de/simbio/index.php/Main_Page>). *To model EEG/MEG using realistically shaped conductivity models of the head, based on FEM*. *Below is a snapshot of examples modelling in monkeys I have done for monkeys, humans and rats:*



* BrainVision’s BrainRecorder and BrainAnalyzer (<https://brainvision.com/>). *To record/preprocess EEG.*
* Brainstorm (<http://neuroimage.usc.edu/brainstorm/>). *To preprocess and analyze EEG/MEG. To solve the forward (based on BEM and FEM) and inverse problem of the EEG/MEG*.
* BrainSuite (<http://neuroimage.usc.edu/neuro/BrainSuite>)
* EEGLAB (<https://sccn.ucsd.edu/eeglab/index.php>). *To preprocess and analyze EEG/MEG. To solve the forward (based on BEM and FEM) and inverse problem of the EEG/MEG*.
* FieldTrip (<https://www.fieldtriptoolbox.org/>). *To preprocess and analyze EEG/MEG. To solve the forward (based on BEM and FEM) and inverse problem of the EEG/MEG*.

## Software for preprocessing and statistical analysis of MRI

* fMRIprep (<https://fmriprep.org/en/stable/>). *To preprocess MRI databases.*
* FreeSurfer (<https://surfer.nmr.mgh.harvard.edu/>). *To extract brain cortical surface and perform group-based statistical analysis (e.g., ANOVA, generalized regressions, etc.)*
* CONN (<https://web.conn-toolbox.org/tutorials>). *To analyze brain functional MRI connectivity*
* SPM (<http://www.fil.ion.ucl.ac.uk/spm/>). *Statistical analysis of brain images*.
* FSL (<http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/>). *Statistical analysis of brain images*.
* CBRAIN and CIVET (<http://www.bic.mni.mcgill.ca/ServicesSoftware/CIVET>)

## Statistical Analysis

* SPSS (<https://www.ibm.com/products/spss-statistics>)
* SAS (<https://www.sas.com/en_us/home.html>)

## Other

* EPRIME (<https://pstnet.com/products/e-prime/>). *To design psychophysiological stimulation paradigms*.

# Book Chapters

1. Valdés-Hernández, P. A. Neuroimágenes. 2010. In: Programa de Altos Estudios. Módulo Neuroimágenes y Neuroinformática. pp. 8-43. Chapter 1 Neuroimágenes (textbook for a virtual MSc programme in Neuropsychology. Spain)

# Published abstracts in conference proceedings

1. **Valdes-Hernandez, P.A.**, Johnson A.J., Montesino-Goicolea, S., Laffitte Nodarse, C., Bashyam, V., Davatzikos, Fillingim, R.B, Cruz-Almeida, Y. (2023). Accelerated brain aging mediates the association between psychological profiles and clinical pain in knee osteoarthritis. The Journal of Pain 24 (4), 79. <https://doi.org/10.1016/j.jpain.2023.02.229>
2. **Valdes-Hernandez, P.A.**, Montesino-Goicolea, S., Cruz-Almeida, Y. Chronic musculoskeletal pain moderates the association between sleep quality and Dorsostriatal-sensorimotor resting state functional connectivity in community-dwelling older adults. The Journal of Pain 23(5), 43-44. <https://doi.org/10.1016/j.jpain.2022.03.166>
3. Yeater, T. D., Hoyos, L., Peraza, J. A., **Valdes Hernandez, P.**, Clark, D. J., Allen, K. D., & Cruz-Almeida, Y. (2021). Pain differences in sympathetic nervous system reactivity during simple and complex walking tasks: potential cerebral mechanisms. The Journal of Pain, 22(5), 601–602. <https://doi.org/10.1016/j.jpain.2021.03.096>
4. Wang, Q., **Valdes-Hernandez, P. A.**, & Sosa, P. V. (2018). S129. An open source platform for concurrent EEG/ECoG comparisons. Clinical Neurophysiology, 129(2018), e190. <https://doi.org/10.1016/j.clinph.2018.04.489>
5. Iturria-Medina, Y., Ontivero-Ortega, M., Canales-Rodríguez, E. J., Melie-García, L., **Valdés-Hernández, P.**, & Pérez-Fernández, A. (2013). Complex Mouse Brain Anatomical Network Attributes Estimated via Diffusion- MRI Data and Graph Theory. In IFMBE Proceedings, V Latin American Congress on Biomedical Engineering CLAIB, Haban, Cuba (Vol. 33, pp. 65–68). <https://doi.org/10.1007/978-3-642-21198-0_17>
6. Bringas-Vega, M. L., Villareal-Recio, Y., Hernandez, G., **Valdes-Hernandez, P. A.**, Lage-Castellanos, A., Yturria, Y., & Valdes-Sosa, P. A. (2012). Diffusion Weighted Imaging (DWI) Multi-Voxel Pattern Analysis (MVPA) of Intelligence in the Cuban Population. *Psychophysiology*, 49, S103-S103. <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1469-8986.2012.01440.x>
7. **Valdés Hernández, P. A.**, Von Ellenrieder, N., Ojeda González, A., Muravchik, C., Kochen, S., & Valdés Sosa, P. A. (2008). 66. Solving EEG forward and inverse problem for subject lacking of a MRI. Clinical Neurophysiology, 119(9), e115–e116. <https://doi.org/10.1016/j.clinph.2008.04.082>
8. Ojeda González, A., **Valdés Hernández, P.**, & Valdés Sosa, P. A. (2008). 125. EEG spectra correlates with diffusion tensor fractional anisotropy. Clinical Neurophysiology, 119(9), e130. <https://doi.org/10.1016/j.clinph.2008.04.141>
9. **Valdés-Hernández, P. A.**, von Ellenrieder, N., Ojeda-González, A., Kochen S., Alemán-Gómez Y., Muravchik C., Valdés-Sosa, P.A. (2008). 66. Solving EEG forward and inverse problem for subject lacking of a MRI. Clin. Neurophysiol. 119 (9), e99. <https://doi.org/10.1016/j.clinph.2008.04.082>
10. Alemán-Gómez Y., Melie-García L., **Valdes-Hernández P.** (2006). IBASPM: Toolbox for automatic parcellation of brain structures. Presented at the 12th Annual Meeting of the Organization for Hum Brain Mapp. June 11-15. 2006. Florence. Italy.
11. Iturria-Medina, Y., Canales-Rodriguez, E., Melie-Garcia, L., **Valdés-Hernández, P. A.** (2005). Bayesian formulation for fiber tracking. Presented at the 11th Annual Meeting of the Organization for Human Brain Mapping. p. 26(1)
12. Canales-Rodríguez, E., Melie-García, L., **Valdés-Hernández, P.A.**, Iturria-Medina, Y., Alemán-Gómez, Y., Bouza-Dominguez, J (2005). A new method for extracting information from intra-voxel white matter structures distribution. Presented at the 11th Annual Meeting of the Organization for Human Brain Mapping, June 12-16, 2005, Toronto, Ontario, Canada. Available on CD-ROM in NeuroImage, Vol. 26, No.1.
13. Iturria-Medina, Y., **Valdés-Hernández, P.A.**, Canales-Rodríguez, Y. (2005). Measures of anatomical connectivity obtained from neuro-diffusion images. Presented at the 11th Annual Meeting of the Organization for Human Brain Mapping, June 12-16, 2005, Toronto, Ontario, Canada. Available on CD-ROM in NeuroImage, Vol. 26, No.1.

# Other selected poster presentations in conferences

1. Valdes-Hernandez, P.A.\*, Laffitte Nodarse, C.\*, Johnson A.J., Montesino-Goicolea, S., Bashyam, V., Davatzikos, C., Peraza, J.A, Cole, J.H., Huo Z., Fillingim, R.B, Cruz-Almeida, Y. Brain predicted age difference estimated using DeepBrainNet is significantly associated with pain and function—a multi-institutional and multi-scanner study. Annual Meeting of the Organization for Human Brain Mapping, Montreal, Canada, June 16-20, 2023.
2. Valdes-Hernandez, P.A., Johnson A.J., Montesino-Goicolea, S., Laffitte Nodarse, C., Bashyam, V., Davatzikos, Fillingim, R.B, Cruz-Almeida, Y. Accelerated brain aging mediates the association between psychological profiles and clinical pain in knee osteoarthritis. USASP Conference 2023. April 11-14, 2023.
3. Yeater T.D., Valdes Hernandez P.A., Hoyos L., Peraza-Goicolea J., Clark D.J., Allen K.D, Cruz-Almeida Y. Pain differences in sympathetic nervous system reactivity during simple and complex walking tasks: potential cerebral mechanisms. USASP Conference 2020. December 9-11, 2020.
4. Montesino-Goicolea S., Valdes-Hernandez P.A., Lafitte Nodarse, C., Peraza-Goicolea J.A., Somerville J., Griffith B., Fillingim R.B., Cruz-Almeida Y., UPLOAD2 team. Sex Differences in Brain Structure in Individuals with Knee Osteoarthritis Pain. USASP Conference 2020. December 9-11, 2020.
5. Valdés-Hernández P.A., Montesino-Goicolea S., B. Fillingim R.B., Riley III, J.L., Porges E., Woods A., Cohen R., Cruz-Almeida Y. Hippocampus, salience and default resting state resting state functional connectivity is associated with chronic pain duration in community-dwelling older adults. Annual meeting of the Society for Neuroscience, Chicago, US, October 19-23, 2019.
6. Montesino-Goicolea S., Valdes-Hernandez P.A, Riley III J.L., Fillingim R.B., Woods A., Porges E., Cohen R., Cruz-Almeida Y. Right putamen functional connectivity is associated with chronic pain and sleep quality in older adults. Annual meeting of the Society for Neuroscience, Chicago, US, October 19-23, 2019.
7. Valdés-Hernández P., Bernal B., Sanganahalli B.G., Moshkforoush A., Dunoyer C., Figueredo P., Hyder F., Riera J.J. (2017). Discrimination of the clinically relevant negative BOLD responses during interictal focal epilepsy. Annual Meeting of the American Epilepsy Society, Washington, US, December 1-5, 2017.
8. Valdés-Hernández, P.A., Bae, J., Song, Y., Riera, J.J. (2015) Electroencephalographic Source Imaging in Rats: Methodological Aspects and Validation. Annual Meeting of the Biomedical Engineering Society, Tampa, US, October 7-10, 2015.
9. Valdés-Hernández, P.A., Trujillo-Barreto, N.J., Valdés-Sosa, P.A. (2015) Fast Electrical Source Imaging without the subject´s MRI: Bayesian Modal Averaging across heads. 21st Annual Meeting of the Organization for Human Brain Mapping, Honolulu, US, June 14-18, 2015 (Travel Award).
10. Valdés-Hernández, P.A., Valdés-Sosa, P.A., Ojeda-González, A. (2007) EEG Alpha Peak Frequency Correlates with Diffusion Tensor Fractional Anisotropy. 13th Annual Meeting of the Organization for Human Brain Mapping, Chicago, US, June 10-14, 2015.

# Selected invited lectures at conferences and workshops

1. Sleep and Pain in Older Adults: Potential Cerebral Mechanisms. February 6th 2021 Sandra-Edwards Colloquium. College of Public Health & Health Professions. University of Florida.
2. Hippocampus, Salience and Default Resting State Functional Connectivity is Associated with Chronic Pain Duration in Community-Dwelling Older Adults. February 1st 2020 Sandra-Edwards Colloquium. College of Public Health & Health Professions. University of Florida.
3. Valdés-Hernández, P. A., Bernal, Byron, Moshkforoush, Arash, Dunoyer, Catalina, Khoo, Hui Ming, Bosch-Bayard, Jorge, von-Ellenrieder, Nicolas, Gotman, Jean, & Riera, Jorge J. Identification of negative BOLD responses using windkessel models. June 17-21 2018, Annual Meeting of the Human Brain Mapping, Singapore.
4. Chronic oxytocin administration in older men modulates functional connectivity of posterior Superior Temporal Sulcus during animacy perception. October 2019 Annual meeting of the Society for Neuroscience.
5. Cuban Neuroscience Center Workshop, the next 25 years. October 2014 Multimodal databases and EEG imaging.
6. Workshop: Controversies in EEG Source Imaging, Chengdu, China. August 2014. Surrogate models for EEG Source imaging.
7. CIMPA Research School. PDE methods in Biology and Medicine. Mathematics and Cybernetics Faculty, Havana University, Havana, Cuba. June 24 - July 05, 2013. Summer School. Introducing neural field models.
8. Latin American Congress on Biomedical Engineering CLAIB, Habana, Cuba. May 2011. An in vivo MRI template set for morphometry, tissue segmentation, fMRI localization and anatomical connectivity in rats.
9. Work Meeting: Clinical Development of HeberFERON (CIGB-128) for treatment of Malign Glioms, Havana. October 2010. Physical Principles of low and high field MRI.
10. Latin American Brain Mapping Project (LABMAN) Workshop, Havana, Cuba. June 2008. Cuban Bain Mapping Project. Status report.
11. 4th Congress of the Cuban Society and First Ibero-American Workshop on Clinical Neurophysiology, Varadero, Cuba. March 2008. Approximate Geometrical Models to Solve the EEG problems. A database contribution.
12. Latin American-UK Workshop, Havana, Cuba. November 2006. Cuban Human Brain Mapping Project. Relating MRI and EEG.

# Selected invited lectures at other institutions

1. Invited presentation at the Max Planck Institute for Evolutionary Anthropology, Leipzig. February 2014. Surrogate models for EEG Source Imaging.
2. Invited presentation at the Institute for Biomagnetism and Biosignalanalysis, University of Muenster, Muenster, Germany. February 2014. Surrogate models for EEG Source Imaging
3. Invited lecture at the Faculty of Biology, Havana University, Cuba. May 2013. Brief Introduction to Neuroimaging
4. Invited lecture at the Faculty of Psychology, Havana University, Cuba. October 2012. Brief Introduction to Neuroimaging
5. Invited presentation at the University of La Plata. June 2007. Possible MRI-based measures of axonal conduction velocity
6. Invited lecture at the University of Computer Sciences, Havana. October 2007. Cuban Human Brain Mapping Project. Processing of Magnetic Resonances Imaging.
7. Invited presentation at the University of Montreal. May 2007. Influence of white matter structure, as measured by MR-DTI, on EEG alpha rhythm

# Current and past collaborators

* Kyle Allen, PhD. Biomedical Engineering Department, University of Florida, Gainesville, USA.
* Marcelo Febo, PhD. Department of Psychiatry, University of Florida, Gainesville, USA.
* Natalie Ebner, PhD. Department of Psychology, University of Florida, Gainesville, USA.
* Christos Davatzikos, PhD. AI2D Center for AI and Data Science for Integrated Diagnostics; and Center for Biomedical Image Computing & Analytics, Perelman School of Medicine, University of Pennsylvania, USA.
* Qing Lu, PhD. Department of Biostatistics, University of Florida, Gainesville, USA.
* James Cole, PhD. University College of London. UK
* Yenisel Cruz-Almeida, PhD. Department of Community Dentistry & Behavioral Science , University of Florida, Gainesville, USA
* Roger Fillingim, PhD. Pain Research and Intervention of Excellence (PRICE), University of Florida, Gainesville, USA
* Huo,Zhiguang, PhD. Department of Biostatistics, University of Florida, Gainesville, USA
* Jorge Riera, PhD. Neuronal Dynamic Mass, Biomedical Engineering Department, Florida International University, Miami, USA
* Alan Evans. Montreal Neurological Institute, Montreal, Canada
* Jeffrey Schall, PhD. Department of Psychology, Vanderbilt University, Nashville, USA
* Jean Gotman, PhD. Montreal Neurological Institute, McGill University, Montreal, Canada
* Yoichiro Mori, PhD. Institute of Mathematics, University of Minnesota, Minneapolis, USA
* Carsten Wolters, PhD. Institute for Biomagnetism and Biosignalanalysis, University of Muenster, Germany
* Ruyta Kawashima, PhD. Institute of Development, Aging and Cancer, Tohoku University, Sendai, Japan.
* Carlos Muravchik, PhD and Dr. Nicolás von Ellenrieder, PhD. LEICI Universidad Nacional de la Plata, Argentina
* Nelson J. Trujillo Barreto, PhD. Institute of Brain, Behavior and Metal Health, University of Manchester, UK
* Yasser Iturria Medina, PhD. Montreal Neurological Institute, McGill University, Montreal, Canada

# Honors and distinctions

* Winner of the Travel Award to the OHBM Conference, Hawaii, USA. 2015
* Annual Award for Outstanding Scientific Contribution. Cuban Neuroscience Center, Cuba. **Valdes-Hernandez P.A.**, Ojeda-González A., Martínez-Montes E., Lage-Castellanos A., Virués-Alba T., Valdés-Urrutia L., Valdes-Sosa P.A. White matter architecture rather than cortical surface area correlates with the EEG alpha rhythm. Neuroimage (2010), 49, 2328-2339 doi: 10.1016/j.neuroimage.2009.10.030
* Annual Award of the Cuban Academy of Science: Methods for the study of brain anatomical and morphological connectivity. Applications in human and animals. Yasser Iturria Medina, Lester Melie García, Erick J. Canals Rodríguez, **Pedro Antonio Valdes-Hernandez**, Gretel Sanabria Díaz, Yasser Alemán Gómez. 2012

# Significant Contributions to software development (>20%)

* Co-developer of the Commercial software Neuronic Image Processor system. Neuronic S.A. 2007-2016 ([www.neuronicsa.com](http://www.neuronicsa.com))
* Co-developer of the non-commercial software T2-CARB for rat image processing ([www.neuronicsa.com](http://www.neuronicsa.com))