Karen Paco Mendivil

Personal Information

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Professional Objective

Bioengineering professional who combines AI/ML, Protein LLM fine-tuning and Molecular Dynamics expertise with bench biochemistry, expression, molecular biology and immunology experience. Management of multiple scientists in dynamic goal-oriented settings.

Leadership & Strategy :

Scientific strategy development, cross-functional team leadership, mentorship & talent development, R&D pipeline management, industry-academic collaborations, and innovation in AI-driven therapeutic discovery.

Computational Skills

Machine Learning : Application of large language models (LLMs), transformer architectures, and GraphRAG to antibody optimization, and antigen-specific BCR prediction.

Scientific Computing & Pipelines : Development of scalable bioinformatics workflows using Python and R ; experience with high-performance computing environments (HPCC), and cloud-based tools.

Single-Cell & Omics Data Analysis : Expertise in transcriptomic and single-cell RNA-seq analysis (Seurat, Scanpy), immunoinformatics, and NGS/genomic pipelines for immune profiling and vaccine response characterization.

Protein Modeling & Molecular Simulations : Protein structure prediction, docking, and molecular dynamics simulations. (GROMACS - MM-PBSA)

Experimental Skills

Single-Cell Technologies : Single-cell RNA sequencing, immune receptor profiling, and combinatorial library construction.

Protein Expression & Binding Assays : Recombinant expression and purification of complex proteins, including intrinsically disordered proteins (IDPRs) and membrane proteins, using bacterial and mammalian systems ; purification via FPLC and HPLC ; biophysical and kinetic characterization using SPR, ITC, MST, DLS, DSF, BLI, and stopped-flow kinetics to assess protein-ligand and antigen-antibody interactions.

Therapeutic Design : Development of vaccine constructs including virus-like particles (VLPs), subunit proteins, and peptide-based vaccines ; antibody engineering in diverse formats (vHH, scFc, full-length IgGs) ; preclinical immunogenicity evaluation using murine models and single-cell transcriptomics.

Education

— Accepted to attend the **Deep Learning for Science Summer School** (2025)
Lawrence Berkeley National Laboratory – International Computer Science Institute (ICSI)

— **Ph.D. in Applied Life Sciences** (2018–2021)
Keck Graduate Institute, Claremont, CA, USA
  — Alzheimer's disease immunotherapy using TMV to target pathological tau
  — Development of SARS-CoV-2 vaccine candidates targeting intrinsically disordered domains and heparin-binding motifs

— **Research Internship – Protein Biophysics** (2017)
Mario Amzel's Laboratory, Johns Hopkins University
Thesis : "Study of stability and affinity profile of MHC-I in Cobb-500 chicken using 8/9-mer peptides for MHC epitope prediction tool development"

— **M.Sc. in Biochemistry and Molecular Biology** (2014–2016)
Universidad Peruana Cayetano Heredia, Lima, Peru

— **Postgraduate Diploma in Immunology** (2015)
Universidad Peruana Cayetano Heredia, Lima, Peru

— **B.Eng. in Biotechnology Engineering** (2008–2014)
Universidad Católica de Santa María, Arequipa, Peru

Employment History

Postdoctoral Fellow – Immunology & Computational Biology (AI/ML) *Keck Graduate Institute, Jan 2022 – Present*

- Led the design and development of vaccine constructs, including peptide-based vaccines and virus-like particles (VLPs), integrating computational and experimental approaches
- LLMs for antibody specificity prediction, de novo antibody design, and optimization.
- Single-cell transcriptomic analysis to uncover immune insights
- Designed and characterized antibody libraries using yeast and ribosome display.
- Conducted structural analysis and MD simulations to validate protein interactions.
- Led preclinical immunogenicity studies using murine models and transcriptomic using 10X Genomics BEAM Ab platform.
- Executed recombinant protein expression, FPLC/HPLC purification, and binding assays (SPR, ITC, BLI, DLS, stopped-flow kinetics)
- Applied differential expression and clustering algorithms for PBMC transcriptomics

Senior Scientist – Bioinformatics Computational Biology *Loam, Nov 2020 – Aug 2023*

- Modeled metalloproteins and metal-organic frameworks using docking and MD simulations
- Built bioinformatics workflows for NGS and functional genomics using Python, R, and cloud platforms
- Applied statistical modeling and ML to guide carbon sequestration strategies
- Led collaborations translating computational findings into experimental pipelines and product development.

Scientist – Biochemistry *Prisa Biotech, Jan 2014 – Mar 2018*

- Analysis of enzymes and mycotoxin sequestrants efficiency for poultry and livestock. Designed in vitro assays for product validation, and field implementation of poultry vaccination strategies

Research Assistant – Molecular Biology *DNA Biotechnology, Jan 2013 – Jan 2014*

- Routine molecular biology techniques : SDS-PAGE, qPCR, RNA/DNA extraction, Western blot. Cell culture of stem cells.

Patents

- Chaudhury, A., Paco, K., et al. (2023). Methods for the reduction of methane production in ruminants (WO 2023/009899)
- Chaudhury, A., Paco, K., et al. (2024). Inhibition of methane production in ruminants (WO 2024/163774)
- Yang, T., Gupta, I., Paco, K., et al. (2024). Enhanced fungal strains for soil aggregation and carbon sequestration (U.S. Patent App. 63/705,019)
- Nock, T., Paco, K., et al. (2024). Compositions comprising *Beauveria bassiana* and methods of use (WO 2024/197319)

Publications

- Paco, K., Mariana P., et al. (2025). Beyond clonality : Fine-Tuned Protein Language Models Predict Antibody Specificity from Sparse Repertoires. Publication in progress.
- Barroso Da Silva, F. L., Paco, K., et al. (2025). SARS-CoV-2 spike-ACE2 binding insights. *Biophysical Reviews*. https://doi.org/10.1007/s12551-025-01276-z
- Ashraf, F., Paco, K., et al. (2024). LLM-guided antibody maturation. Preprint. https://doi.org/10.1101/2024.12.19.629473
- Paco, K., Zhang, Z., et al. (2024). Identification of antigen-specific BCRs using LLMs. NeurIPS Latinx in AI Workshop (Accepted)
- Paco, K., Zhang, Z., et al. (2024). LLMs for BCR identification. RAGSAB Workshop Presentation, Los Angeles, CA
- Ayliffe, M., Paco, K., et al. (2025). Curvularia bromoform biosynthesis and methane mitigation. *Biotechnology Reports*. https://doi.org/10.1016/j.btre.2025.e00876
- Paco, K., et al. (2016). *Piper aduncum* on fibroblast healing. *Revista Peruana de Medicina Experimental y Salud Publica*, 33(3). https://doi.org/10.17843/rpmesp.2016.333.2329
- Tume, L., Paco, K., et al. (2016). CD133 in breast cancer stem cells. *Gaceta Mexicana de Oncologia*, 15(1). https://doi.org/10.1016/j.gamo.2016.01.003

Awards

- 2025 AAI Trainee Poster Award and Travel Award – American Association for Immunology.
- Travel award and accepted to attend School on Biological Physics and Biomolecular Simulations in the Machine Learning Era. April 2025.
- NeurIPS 2024 AI Workshop – Travel Award.
- AI/ML in Bioprocessing/Biotech Workshop 2024 – Travel Award.