Bernardo Chombo Álvarez

Genomic Sciences undergraduate student

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Professional profile

I am a Genomic Sciences undergraduate student at the National Autonomous University of Mexico (UNAM) with interest in neurodevelopmental disorder genomics and the usage of computational biology and bioinformatics for the identification and comprehension of their involved genes, as well as the usage of gene therapies for medical purposes. I have a strong formation in genomics, omic sciences, genetics, bioinformatics, molecular biology, cell biology, neurobiology immunology, biochemistry, probabilistics, statistics and calculus. I have a critical and ethical performance and social commitment. My personal values are respect, honesty, perseverance, responsibility and dedication. I firmly believe that the study and understanding of neurodevelopmental genomics is capable of generating a positive impact and advances in the medical field, as well as improving people's quality of life. Furthermore, I am fully committed with the data/code availability for the reproducibility and replicability purposes.

Education

- *B.Sc. in Biology (2 semesters),* **National Autonomous University of Mexico - Faculty of Sciences**, 2021-2022
- *B.Sc. in Genomic Sciences,* **National Autonomous University of Mexico - Genomic Sciences Center,** 2022-present
- *Summer student (2 months),* **University of Vienna / Vienna BioCenter - Max F. Perutz Laboratories,** 2024

Languages

Spanish: native
English: full professional proficiency
French: elementary proficiency

Professional interests

Neurodevelopmental disorder genomics, Alzheimer's disease, population genomics, gut-brain axis, bioinformatics, computational biology, stem cells, regulatory networks, transcriptomics, epigenomics, human genetics, genetic engineering, translational medicine.

Professional abilities

Teamwork, solution-focused, proactive, scientific project development

Experimental abilities

- Project management
- Handling of laboratory equipment and instruments
- Synthetic protein production in yeast
- Handling of Atomic Force Microscope
- Handling of Epifluorescence Microscope
- Partial handling of Spinning Disk Confocal Microscope
- PCR, qPCR
- Immunostaining
- Tissue extraction
- Western Blot
- ELISA
- EMSA
- *In situ* Hybridization Chain Reaction (HCR)
- Cell culture
- Explant culture
- Tissue extraction
- DNA extraction
- Mice handling (over 2 years of experience)
- Buffers and lab. solutions preparation

Computational abilities

- Database creation and management
- Algorithm creation
- Data Science
- Programming and script creation: *Bash / Shell, R / BioConductor, Python / BioPython, C, Perl, Markdown, Quarto, LateX*
- Metagenomics analysis: *MEGAHIT, metaSPADES, MetaVelvet, MetaQuast, BUSCO, Kraken2, Kaiju, DIAMOND, MetaPhlAn3*
- Genome Assembly: *FastQC, MultiQC, Trimmomatic, Trim Galore, BWA, Bowtie2, Canu, SPADES, Velvet, Quast*
- Primer design: *Primer3, PrimerBLAST*
- RNA-seq analysis: *Limma, EdgeR, DESeq2, and additional libraries*
- scRNA-seq analysis: *OSCA, SingleCellExperiment, Seurat, and additional libraries*
- ChIP-seq analysis
- ATAC-seq analysis
- GWAS
- Motif discovery: *RSAT*
- Motif enrichment: *RSAT, Homer, Meme Suite*
- Protein structure comparisons: *STAMP, MODELLER, AlphaFold*
- DNA sequence comparisons: *BLASTN / BLASTX, Pairwise alignment, ClustalW, Muscle*
- Protein sequence comparisons: *HMMER, DIAMOND, BLASTP / Psi-BLAST*
- Handling of bioinformatic software and computational biology tools: *NextFlow, SnakeMake, SAMtools, BCFtools, Bedtools, STAR, Artemis, Conda, Mamba, Samba*
- Population level analysis *ADMIXTURE, PLINK2*
- Image processing: *Fiji, Illustrator*
- Clustering
- Machine Learning
- Neural Networks
- Notion/Obsidian planning
- Phylogenetics

Research Experience

Laboratory of Dr. Lorenzo Patrick Segovia Forcella, Institute of Biotechnology, National Autonomous University of Mexico

Undergraduate Researcher

Ph.D. Lorenzo Patrick Segovia Forcella's research group / January 6, 2023 – February 29, 2024

- Undergraduate research in charge of M.Sc. Rafael López Sánchez and under the assistance of Ph.D. Lorenzo Patrick Segovia Forcella and the support material of Ph.D. Alejandro Ángel Garciarubio Granados. The work has consisted in the exploration and identification of the diversity of CAZymes (carbohydrate degrading enzymes) in marine sediment samples obtained by the Gulf of Mexico Research Consortium. The aim is to identify the beta diversity, substrate, ecosystem and taxonomy of CAZymes and PULs (polysaccharide utilization loci) identified in the sediments associated with the project's MAGs. For data analysis, scripts were generated in Shell and R.

Laboratory of Biomolecular Engineering and Bionanotechnology, Institute of Chemistry, National Autonomous University of Mexico

Undergraduate Researcher

Ph.D. Armando Hernández Garcia's research group / June 5, 2023 - present

- Undergraduate research in charge of M.Sc. Ximena del Toro Ríos and B.S. Marco Antonio Chávez Piñón. In the project *Targeted-delivery Therapeutic RNA to Breast Cancer Cells through C-S-B Virus-like Proteins* my participation consisted in helping to produce recombinant proteins, and in the projects *Development of a Genetic Detection System for the Four Serotypes of Dengue Virus through CRISPR-Cas12a Machinery* and *Development of a Genetic Detection System for Trypanosoma cruzi (Chagas disease) through CRISPR-Cas12a Machinery* consisted in evaluating the effectiveness of the primers and gRNAs designed for the detection tools, as well as contributing in bioinformatic analysis. Additionally, I participated in the creation of different programs in Python, for example, a program to download bulk data from NCBI and UniProt, a program that uses the BLAST tool and the NCBI database to evaluate the taxonomic diversity of DNA sequences.

Neuroimmune Biology Consortium, Institute of Biotechnology, National Autonomous University of Mexico

Undergraduate Researcher

Ph.D. Leonor Pérez Martínez and Ph.D. Martín Gustavo Pedraza‘s research group / August 5, 2023 - present

- Undergraduate research in charge of M.Sc. Carlos Humberto Martínez Álvarez. In the project S*ensorial neurons and the regulation of immunity in the meninges* for the evaluation of different markers of cell type and activation in meningeal tissues of mouse models of Alzheimer's disease (5xFAD). My participation has consisted in developing skills in the extraction of meninges, in the ethical handling of mice, preparation of tissues for immunofluorescence staining tests and in the design of primers to measure the expression levels of different cellular markers related to Alzheimer's disease. Additionally, I have contributed to the update and improvement of a program for qPCR data analysis and participated in the creation of a program for automated primer design in Python. A publication is expected within two years.

Laboratory of Ph.D. Florian Raible, Max F. Perutz Laboratories, Vienna BioCenter / University of Vienna
Summer School student
Ph.D. Florian Raible's research group / June – August 2024

- Summer student in charge of M.Sc. Leonie Adelmann. In the project *Validating stem cells as targets for a regeneration-promoting hormone* I identified 275 genes which expression was altered by the Methylfarnesoate hormone from different bulk RNA-seq experiments and a Single-cell RNA-seq atlas from the posterior regeneration of the annelid worm *Platynereis dumerilii*. Then, I validated 9 of those genes using the *in situ* Hybridization Chain Reaction technique with which I could confirm that, in fact, the chosen candidates were co-expressed with stem cell marker genes during the *P. dumerilii*'s posterior regeneration process. Moreover, I also performed some motif enrichment analysis to discover common motifs in the upstream region of the differentially expressed genes retrieved from the *P. dumerilii*'s transcriptome, which putatively could be binding motifs for a common transcription factor. Overall, I double-checked the bulk RNA-seq pre-run analysis and coded multiple scripts for the whole project.

Translational Neuroscience Division, Data Science I, Lieber Institute for Brain Development
Undergraduate Researcher
Ph.D. Leonardo Collado-Torres' research group / August 2024 – Present

- Professional training directly in charge of Ph.D. Leonardo Collado-Torres as an RNA-seq, Single-cell RNA-seq, spatial transcriptomics analyst and the opportunity to create R packages for BioConductor community. Currently I am being trained, immediately after this, I will be able to collaborate in different projects for performing the transcriptomic analysis.

Human Population Genomics Laboratory, LANGEBIO Cinvestav
Undergraduate Researcher
Ph.D. Andrés Moreno-Estrada / August 2024 – Present

- Undergraduate research in charge of M.Sc Carmina Barberena Jonas and M.Sc. Daniela Orozco Pérez. Currently I am being trained in the different population genomic analysis such as performing admixtures for unveiling the population's ancestry. I will be able to collaborate in different projects once I am done with the training.

Conferences and Talks

2024 *Presentation of the research project titled "Validating stem cells as targets for a regeneration-promoting hormone" at the Vienna BioCenter's Summer School Symposium*
University of Vienna, Vienna BioCenter.

2024 *Conference of the at the XI National Forum for the Evaluation of the Professional Development of the Female Gender (FONAGE).*
Superior Institute of Technological Sciences of Xalapa.

Honors and Awards

2020 *Finalist in the XXVIII, University Contest, Science Fair.*
National Autonomous University of Mexico.

2021 *Second Place in the area of Health Sciences, Field Research modality, Local category in the XXIX University Contest, Science Fair.*
National Autonomous University of Mexico.

2024 *Awarded with a full scholarship for the Vienna BioCenter Summer School program 2024.*
Vienna BioCenter, Max Perutz Labs, University of Vienna.

Professional References

Leonardo Collado-Torres, Ph.D.
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Lieber Institute for Brain Development.
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Florian Raible, Ph.D.
Principal Investigator, Group "Origin and Diversification of Hormone Systems".
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Martín Gustavo Pedraza Alva, Ph.D.
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Armando Hernández García, Ph.D.
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