RODRIGO ADOLFO REYES FEREGRINO

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EDUCATION

Honours Bachelor of Science + PEY Co-op, University of Toronto — Expected graduation May 2026

- Double major: Computer Science and Chemistry | minor: Philosophy | **Entrance Scholarship.**
- Related coursework: **software design**, software tools and systems programming, enriched data structures, algorithm design, intro to Machine Learning, Computational Chemistry, Structural Biochemistry.

SKILLS

Programming languages: Python, Java, C, C++

Data analysis and scientific computing: Numpy, Pandas, COBRApy, Anaconda, SciPy, Biopython, Scikit-learn, RDKit, Autodock, OpenBabel, Spartan (for DFT and Hartree-Fock calculations).

Other tools: Git, Docker, Unix, Arduino, Raspberry pi.

Languages: Spanish(native), English(C2), and German(C1, exchange semester)

EXPERIENCE

Co-op Student: Bioinformatics developer — May 2024 - April 2025
Sanofi Pasteur Canada - R&D, Molecular Biology Centre — *Toronto, Canada*

- Analyze **large genomics datasets**, including high-throughput sequencing data (up to 4.5 BILLION DNA reads per batch) by harnessing Bash scripting, Python/C++, bio-statistics, and sequence alignment algorithms.
- Develop, test, and optimize (e.g., by incorporating multi-threading/multi-processing) pipelines and internal software tools, deployed in clusters running in hybrid **cloud-computing** platforms.
- My analysis produced valuable insight, impacting over 500 million customers in 150+ countries.

Teaching Assistant — September 2024 - ongoing
University of Toronto — *Mississauga, Canada*

- Lead tutorials for two sections (over 80 students), host office hours, and help design course content for CSC373: Algorithm Design and Analysis.

Dry Lab Lead & Researcher, iGEM Competition — March 2022 - October 2024
iGEM Toronto group, University of Toronto — *Toronto, Canada*

- Collaborate in diverse projects as member of UofT´s synthetic biology research team - and lead of the Dry Lab division - participating in the International Genetically Engineered Machine (iGEM) competition. Website here

2024 Developed a machine learning-based pipeline for generating biologically viable, de novo plasmid sequences. Trained the model on a dataset of 137,000+ plasmid sequences, optimizing for specific features like origins of replication and antimicrobial proteins.

Conducted *in silico* validation, leveraging advanced sequence alignment tools (e.g., BLAST, MASH) and motif discovery techniques to identify key plasmid features.

2023 Led a team of 8 members in the design and implementation of a **metabolic engineering** project.

Utilized genome-scale metabolic models and linear programming optimization (Flux Balance Analysis and Phenotypic Phase Plane analysis) to predict genetic modifications that enhance the efficiency of bacterial metabolic networks. Evaluated over 12,000 genetic variations.

Plan and organize weekly team meetings(over 60 so far), set goals, conduct interviews and ensure completion of milestones. Coordinate with other leads and mentors

Presented research findings through a poster presentation at a conference organized by the Biozone

2022 Used tools such as Primer3 and PrimerExplorer to develop software, which optimized the loop-mediated isothermal amplification (LAMP) reaction for detecting the presence of the fungus causing Oak Wilt disease.

Summer Researcher: Quantum Computing — May 2024 - ongoing
University of Toronto — *Toronto, Canada*

- Develop skills and understanding about the *status quo* of quantum computation - under Professor Nathan Wiebe - through one-to-one lectures and discussions. Apply existing techniques to computational chemistry.
- Focus on quantum algorithms for Hamiltonian simulation, such as QDRIFT, Phase-estimation, Trotter-Suzuki decompositions, Linear Combination Of Unitaries and truncated Taylor series.

Volunteer researcher: Drug Discovery February 2024 - ongoing
Gene2lead *Mississauga, Canada*

- Leverage **unsupervised learning** algorithms to identify candidates for drugs that could serve as MCHR1 antagonists. Worked with molecular structures in SMILES, SEFLIES, and molecular fingerprint representations.
- Develop and automate pipelines for high-throughput screening of ligands that bind to the active site of enzyme, through molecular docking simulations.

Database developer October 2023 - April 2024
Canadian Statistical Sciences Institute (CANSSI) Ontario *Toronto, Canada*

- Capture, enter and analyze data related to CANSSI Ontario operations, events, and programs. Harness existing software (FileMaker, Alchemer, MySQL) as well as develop my own tools with diverse Python libraries.
- Design systems and pipelines for database management and automation, as well as for data cleaning and curation.

PROJECTS

Plasmid.AI: writing new life using machine learning

- Generative model trained to produce **novel** functional plasmid sequences, coupled with *in silico* validation pipeline. Currently, largest open-source toolkit to develop plasmid foundation models.
- Leverage Mamba2 architecture and byte-pair-encoding tokenizer for sequence generation. GitHub: igem-toronto/plasmidai.git

COBRA-FSEOF: Open-source computational tool for bacterial strain design

- A Python-based (COBRApy) implementation of the FSEOF (Flux Scanning based on Enforced Objective Flux) algorithm, based on the work of Choi et al. (2010 GitHub: igem-toronto/cobra-fseof

News article popularity predictor (ML-powered) web app Feb 2024

- **Full-stack** application, developed during a hackathon, for predicting article popularity handling both article text and URL inputs. Extracted 58 features through web-scaping, including **sentiment analysis using NLP**.
- Trained and compared different **Machine-Learning models** (decision tree, linear regression, and random forest regression) on a dataset comprising 40,000 data points, using the number of times shared as target vector. **Tuned hyperparameters** through grid search. see slideshow

AWARDS

- iGEM 2024: **Gold Medal**, Best Model Award, Best Entrepreneurship Award + nominations Best Foundational Advance Project and Best presentation. Project: Plasmid.AI: an intelligent platform to write new life
- Summer Undergraduate Data Science (SUDS) research scholarship, 2024 (7,200 dollars)
- iGEM 2023: **Gold Medal**, Best Model Award, + nominations for Best Climate Crisis Project, Wiki, Integrated Human Practices, and Entrepreneurship. Project: A comprehensive solution to harness landfill gas emissions
- iGEM 2022: **Gold Medal** and Nomination for Best Conservation Project: On-site early diagnostic tool for Oak Wilt disease