Virgile **Andreani**

Postdoc in computational biology

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Research

Postdoc in computational biology — with Jakob Ruess, Lifeware, Inria Saclay

Efficient simulations of nested chemical reaction networks — 2024 -

- Image analysis for exotic microfluidic designs
- Statistical analysis of cell lineages in link to population parameters (project)
- Parallel and efficient implementations for nested chemical reaction networks (project)

Postdoc in computational synthetic biology — Mary Dunlop's lab, BME, Boston University

Elucidating the interactions of stress pathways in cell survival with Bayesian inference — 2021 - 2024

- Investigation of the heterogeneity of cell response to antibiotic treatments
- Resolution of an inverse problem in combinatorial protein design
- Solving of an NP-hard promoter design problem
- Investigation of the interactions of stress pathways in cell survival
- Modernization and overhaul of the DeLTA segmentation and tracking software

PhD in computational biology — Gregory Batt's lab, InBio, Inria & Institut Pasteur

Mathematical modeling of the response of bacterial populations to antibiotic treatments — 2016 - 2020

- Development of a growth-fragmentation structured population model to describe the response of bacteria to antibiotics
- Reduction of this PDE model to a more manageable ODE model
- Parameter inference for the ODE model
- Bayesian inference of cell numbers from CFUs
- Reverse-engineering of a plate-reader communication protocol to write a Python USB driver

Education

PhD in computational biology — Palaiseau, France

École polytechnique — 2016 - 2020

Master's degree in theoretical computer science (MPRI) — Paris, France

École normale supérieure — 2014 - 2015

Master's degree in quantum physics (ENS-ICFP) — Paris, France

École normale supérieure — 2012 - 2014

Bachelor's degree in physics — Paris, France

École normale supérieure — 2011 - 2012

Grants obtained

Sustainable Maintenance of DeLTA: A Core Tool for Quantitative Bioengineering — RSMF, SSI, UK

Project co-lead role in a £150k grant for the maintenance of DeLTA — 2025-2026

Consulting and coaching

Consulting and coaching in Bayesian statistics — Boston

PyMC-Labs — 2024

Preprints

A quantitative approach to easily characterize and predict cell death and escape to β-lactam treatments — https://doi.org/10.1101/2021.07.16.452741

V. Andreani*, V. Gross*, L. You, P. Glaser, I. El Meouche, G. Batt — accepted in Nature Communications

Publications

DeLTA 3.0: a modern segmentation and tracking tool for microscopy images — https://doi.org/10.21105/joss.10279

V. Andreani, J.B. Lugagne, O. O'Connor, M. J. Dunlop — JOSS 2026

Evaluating the predictive power of combined gene expression dynamics from single cells on antibiotic survival https://doi.org/10.1128/msystems.01588-24

R. N. Alnahhas*, **V. Andreani***, M. J. Dunlop — mSystems 2025

Generating information-dense promoter sequences with optimal string packing https://doi.org/10.1371/journal.pcbi.1012276

V. Andreani*, E. J. South*, M. J. Dunlop — PLOS Computational Biology 2024

Comprehensive Screening of a Light-Inducible Split Cre Recombinase with Domain Insertion Profiling https://doi.org/10.1021/acssynbio.3c00328

N. Tague, **V. Andreani**, Y. Fan, W. Timp, M. J. Dunlop — ACS Synthetic Biology 2023

PyMC: a modern, and comprehensive probabilistic framework in Python https://doi.org/10.7717/peerj-cs.1516

O. Abril-Pla, **V. Andreani**, C. Carroll, L. Dong, C. J. Fonnesbeck, M. Kochurov, R. Kumar, J. Lao, C. C. Luhmann, O. A. Martin, M. Osthege, R. Vieira, T. Wiecki, R. Zinkov — PeerJ Computer Science 2023

Mapping single-cell responses to population-level dynamics during antibiotic treatment https://doi.org/10.15252/msb.202211475

K. Kim, T. Wang, H. R. Ma, E. Şimşek, B. Li, **V. Andreani**, L. You — Molecular Systems Biology 2023

Dynamic gene expression and growth underlie cell-to-cell heterogeneity in *Escherichia coli* stress response https://doi.org/10.1073/pnas.2115032119

N. M. V. Sampaio, C. M. Blassick, **V. Andreani**, J.-B. Lugagne, M. J. Dunlop — PNAS 2022

Optimal control of an artificial microbial differentiation system for protein bioproduction https://doi.org/10.23919/ecc.2019.8795858

É. Weill, **V. Andreani**, C. Aditya, P. Martinon, J. Ruess, G. Batt, F. Bonnans — ECC 2019

Applying ecological resistance and resilience to dissect bacterial antibiotic responses https://doi.org/10.1126/sciadv.aau1873

H. R. Meredith, **V. Andreani**, H. R. Ma, A. J. Lopatkin, A. J. Lee, D. J. Anderson, G. Batt, L. You — Science Advances 2018

Software

PyMC - Bayesian Modeling and Probabilistic Programming in Python pymc-devs/pymc

Core Developer — 2022 - Present

DeLTA - Deep Learning for Time-Lapse Analysis delta-microscopy/delta

Maintainer — 2021 - Present

rebop - A fast simulator for chemical reaction networks Armavica/rebop

Author — 2018 - Present

Distinctions

France Cyber Security Challenge — **ANSSI**

Ranked 31st/1524 — 2022

Bioinformatics Contest — **Bioinformatics Institute and ITMO University**

Ranked 12th/5700 — 2021

Bioinformatics Contest — **Bioinformatics Institute and ITMO University**

Ranked 9th/3329 — 2019

HashCode optimization contest — **Google**

Reached top 3 of the extended rounds — 2017-2019

Southwestern Europe Regional Contest — **ACM ICPC**

Silver medal — 2011

Skills and hobbies

Computing **Linux**, **Python**, **Rust**, **git**, C, C++, Mathematica

Languages **French**, **English**, German (unmaintained), Italian & Swedish & Japanese (notions)

General **Programming**, **Optimization**, Robotics, Cyber security, Tap dance, Origami, Aikido

Teaching and writing

Author of exemplars (*corrigés*) for the *Grandes Écoles* entrance exams — **Éditions H&K**

Physics, Computer Science, Modelling — 2014 - Present

Physics examinations in *classes préparatoires* — **Lycée Fénelon, Paris**

Physics, PCSI & PC* — 2013 - 2015

Science teaching in an elementary school — **École des cheminets, Paris**

With the association *La main à la pâte* — 2011 - 2012

Student supervision

Vishvas Ranjan — **Inria, Saclay**

Research engineer — 2025

Vishal Shah — **BME, Boston University**

PhD rotation — Winter 2022

James M. Roberts — **BME, Boston University**

PhD rotation — Fall 2022

Dhimiter Cobani — **BME, Boston University**

PhD rotation — Summer 2022

Albin Salazar — **Institut Pasteur, Paris**

M2 research internship — Spring 2019

Shuang Li — **Institut Pasteur, Paris**

M1 research internship — Spring 2018

Research internships

Research internship — **supervised by Gregory Batt, Lifeware, Inria Saclay - IdF**

A mechanistic model of metabolism and growth at the single-cell level — October - August 2016

Research internship — **supervised by Marc Pouzet, Parkas, ENS**

Distributed simulation of hybrid systems — March - August 2015

Research internship — **supervised by Werner Krauth, LPS, ENS**

Event-chain algorithm for the hard spheres problem in the isothermal-isobaric ensemble — February - March 2014

Research internship — **supervised by Rainer Blatt, Inst. for exp. physics, Innsbruck University**

Frequency stabilization of a diode laser for quantum information processing — February - July 2013

Research internship — **supervised by Anne Anthore, Lab. de photonique et nanostructures, Marcoussis**

Building of a low-noise cryogenic amplifier, in the scope of a quantum electronics experiment — June - July 2012

Research internship — **supervised by Amel Korichi, CNSM, IN2P3, Orsay**

Development of a gamma-ray tracking algorithm for the AGATA detector — July 2009