LUCA CELEBRANO

Medical Doctor Candidate (MD) · Translational & Computational Oncology
Department of Clinical Medicine and Surgery, Università degli Studi di Napoli Federico II · TIGEM
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EDUCATION & MEDICAL TRAINING

Laurea Magistrale a Ciclo Unico in Medicina e Chirurgia (MD Candidate)
Scuola di Medicina e Chirurgia, Università degli Studi di Napoli Federico II | 2015 – Present (Expected Graduation: 2026/2027)

- Clinical and surgical clerkships across university hospital departments (Azienda Ospedaliera Universitaria Federico II).
- Clinical core curriculum focus: Medical Oncology, Thoracic Oncology & Respiratory Diseases, Clinical Pharmacology, and Internal Medicine.
- Master's Thesis research in collaboration with TIGEM (Telethon Institute of Genetics and Medicine) on spatial multi-omics, reaction-diffusion modeling, and microenvironmental drug resistance in thoracic malignancies.

CLINICAL & TRANSLATIONAL RESEARCH INTERESTS

- **Thoracic Medical Oncology:** Targeted therapy in early-stage and advanced EGFR-mutated NSCLC, adjuvant TKI protocols (ADAURA), and minimal residual disease (MRD) persistence mechanisms.
- **Biophysical Drug Delivery & Microenvironment:** Reaction-diffusion modeling of perivascular pharmacological sanctuaries, interstitial fluid hypertension (IFP), and Starling-Darcy fluid mechanics in solid tumors.
- **Bedside Precision Biomarkers:** Engineering of composite clinical-histogenomic risk scores (Composite Resistance Index, CRI) to guide adjuvant treatment de-escalation and vascular normalization consolidation.
- **Spatial Omics & Computational Biology:** Multi-scale integration of 10x Genomics Visium HD spatial transcriptomics, single-cell RNA-seq, and evolutionary game theory in clinical patient biopsies.

PUBLICATIONS, PREPRINTS & SCIENTIFIC MANUSCRIPTS

The Spatial-Genomic Oncology Continuum: A Biophysical Reaction-Diffusion Theory of Pharmacological Sanctuaries, the Post-ADAURA Cessation Dilemma, and the SG-ADAURA Clinical Trial Protocol
Celebrano L. (Solo & Corresponding Author) · Research Square (Springer Nature Preprint), 2026. DOI: 10.21203/rs.3.rs-11530312/v1 | October 2026

- Status: In Formal Peer Review / Under Consideration at Nature Portfolio (Scientific Reports).
- Presents an analytical reaction-diffusion theory resolving the post-adjuvant osimertinib relapse paradox, validated across 6 independent cohorts totaling 3,205 patients.
- Formulates the Composite Resistance Index (CRI = 0.47S + 0.33G + 0.20M) with C-index 0.84 on MSKCC cohort (N = 604) and designs the prospective Phase III SG-ADAURA trial.

A Biophysical Reaction-Diffusion Framework for Conditional Sub-Threshold Compartments in Solid Tumors: An Exploratory Translational Model
Celebrano L. (Solo & Corresponding Author) · Research Square (Springer Nature Preprint), 2026. DOI: 10.21203/rs.3.rs-11633521/v1 | November 2026

- Establishes an analytical framework quantifying sub-therapeutic perivascular annuli (Δr = 34.11 μm, 31.28% of viable cord volume) and adversarial stress-testing across invasive margins, CNS, and ctDNA shedding limits.

InSituGame: In Situ Spatial Evolutionary Game Assay for Inferring Tumor Subclonal Payoff Matrices and Exploring Adaptive Therapy in Intact Human Biopsies
Celebrano L. (Solo & Corresponding Author) · Submitted to Bioinformatics (Oxford University Press / ISCB, MS ID: BIOINF-2026-3787) · CERN Zenodo DOI: 10.5281/zenodo.23585216 | November 2026

- Formulates an ergodic space-for-time EGT framework inferring subclonal payoff matrices from spatial transcriptomics to design adaptive therapy regimens with serial section concordance (r = +0.811, p = 0.0079).

COMPUTATIONAL ONCOLOGY SOFTWARE & OPEN-SOURCE WORKFLOWS

- **spatial-continuum (Lead Developer):** Pure-Python & containerized biophysical reaction-diffusion modeling solver and perivascular sanctuary analysis engine. Officially indexed in ELIXIR bio.tools (biotools:spatial-continuum-oncology), Bioconda (conda install -c bioconda spatial-continuum), PyPI, and Quay.io BioContainers.
- **Official Snakemake Wrapper (bio/spatialcontinuum):** Officially accepted and merged into the upstream snakemake/snakemake-wrappers repository, establishing standardized, reproducible workflow execution for high-throughput computing clusters worldwide (2026).
- **nf-core / Nextflow Modules Contributor:** Contributed official production modules to nf-core/modules (spatialcontinuum/cricalc, insitugame, samtools/collate), enforcing strict Nextflow DSL2 linting, containerization, and continuous integration.
- **InSituGame & Spatial Sanctuary Packages:** Open-source toolkits for spatial evolutionary game dynamics and Attention-MIL microenvironmental decoupling, archived on CERN Zenodo and indexed in ELIXIR bio.tools.
- **Clinical Decision Web Hub & Simulators:** Interactive research laboratory, 3D WebGL digital twin, and bedside clinical decision simulator (https://lucacelebrano.me) and Hugging Face spaces. Officially featured in emmabostian/developer-portfolios (GitHub, 10,000+ stars).

PROSPECTIVE CLINICAL TRIAL PROTOCOLS

SG-ADAURA Phase III Clinical Protocol (Principal Investigator & Study Chair: Luca Celebrano)
Proposed Multicenter Randomized Phase III Trial (N = 800 Patients) | 2026

- Risk-stratified adjuvant osimertinib trial comparing standard 36-month cessation vs CRI-directed de-escalation (Tier 1) and vascular remodeling consolidation (Tier 3; osimertinib + ramucirumab). Submitted to AstraZeneca Target Innovation (Proposal ID: 8803).

SOCIETY MEMBERSHIPS & PROFESSIONAL AFFILIATIONS

- European Society for Medical Oncology (ESMO): Student / Young Oncologist Member (2026 – Present).
- Associazione Italiana di Oncologia Medica (AIOM): Membro Aderente / Studente (2026 – Present).
- American Association for Cancer Research (AACR): Associate Member Applicant (2026).

OPEN SCIENCE & COMMUNITY WORKFLOW CONTRIBUTIONS

- **Upstream Ecosystem Integration:** Merged pull requests across leading computational biology ecosystems, including snakemake/snakemake-wrappers (#6233), nf-core/modules (#13487, #13471, #13039), and Bioconda recipes (#70930, #70893, #70840).
- **Reproducibility & Open Data:** Deterministic Conda lockfiles, Singularity/Apptainer containers, and open-access data packages indexed under FAIR guidelines on CERN Zenodo (DOI: 10.5281/zenodo.23585216) and Figshare.

TECHNICAL & COMPUTATIONAL COMPETENCIES

- **Programming & Computational Stack:** Python (NumPy, SciPy, pandas, scikit-learn, PyTorch), Nextflow (DSL2), Snakemake, R (Bioconductor, Seurat), SQL, TypeScript, WebGL/Three.js.
- **Translational Oncology & Omics:** 10x Genomics Visium HD spatial transcriptomics, single-cell RNA-seq, variant calling pipelines, Starling-Darcy microfluidics, reaction-diffusion partial differential equations, evolutionary game theory.
- **Infrastructure, Containers & DevOps:** Docker, Singularity/Apptainer, Bioconda, Conda-Forge, Quay.io BioContainers, GitHub Actions CI/CD automation, HPC cluster job scheduling (SLURM, SGE).