Elia Mascolo

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Research interests

Evolution of biological information, transcriptional regulatory systems, gene networks, mobile genetic elements.

Academic position

Postdoctoral researcher
ISTA, Austria *Nov 2025 - present*
Mentor: Gašper Tkačik
Topic: Evolution of transcriptional regulatory codes.

Education

PhD in Computational and Theoretical Biology
UMBC, Baltimore, USA *2025*

MS in Molecular Biology of the Cell
UniMi, Milan, Italy *2020*

BS in Biological Sciences
UniMi, Milan, Italy *2018*

Research experience

- **PhD research** in the Erill Lab (UMBC) *Jun 2021 – Jul 2025*
  Topic: Evolution of transcriptional regulatory systems
- Internship in the Lobo Lab (UMBC) *Mar 2021 – May 2021*
  Topic: Prediction of phenotype-specific gene networks
- Internship in the Kann Lab (UMBC) *Jan 2021 – Mar 2021*
  Topic: Characterization of cancer mutations based on changes in protein stability
- Internship in the Erill Lab (UMBC) *Aug 2020 – Dec 2021*
  Topic: Development of a composite motif discovery algorithm
- **MS thesis research** in the Brilli Lab (UniMi) *Sep 2018 – Apr 2020*
  Topic: Prediction of global gene regulatory networks in Bacteria

Skills

Mathematical skills	Information theory, Bayesian statistics, statistical mechanics, dynamical systems
Computational skills	Algorithm design, evolutionary computation, parallel computing (MPI), evolutionary simulations, version control (Git, GitHub)
Programming languages	Python, Bash, R, C, Matlab, LaTeX
Spoken languages	English (fluent), Italian (native)

Publications

*co-first authors

Pre-prints or in preparation

- Emmauel Mekasha*, **Elia Mascolo***, Ivan Erill. "Mutational Robustness and Evolvability of Encoding Strategies for Transcription Factor Binding Motifs." [*manuscript in preparation*]
- **Elia Mascolo**, Réka Borbély, Santiago Herrera-Álvarez, Calin C Guet, Justin Crocker, Gašper Tkačik. "Long-term evolution of regulatory DNA sequences. Part 1: Simulations on global, biophysically-realistic genotype-phenotype maps." *arXiv*, (January 27, 2026). https://doi.org/10.48550/arXiv.2601.19681. [*pre-print*]
- **Elia Mascolo**, Réka Borbély, Noa Ottilie Borst, Nicholas H Barton, Justin Crocker, Gašper Tkačik. "Long-term evolution of regulatory DNA sequences. Part 2: Theory and future challenges." *arXiv*, (January 29, 2026). https://doi.org/10.48550/arXiv.2601.21480. [*pre-print*]
- **Elia Mascolo**, and Ivan Erill. "Information Theory of Composite Sequence Motifs: Mutational and Biophysical Determinants of Complex Molecular Recognition." *bioRxiv*, (November 15, 2024). https://doi.org/10.1101/2024.11.11.623117. [*pre-print*]

Peer-reviewed journal articles

- Tagide deCarvalho*, **Elia Mascolo***, Steven M Caruso, Júlia López-Pérez, Kathleen Weston-Hafer, Christopher Shaffer, and Ivan Erill. "Simultaneous Entry as an Adaptation to Virulence in a Novel Satellite-Helper System Infecting *Streptomyces* Species." *The ISME Journal* 17, no. 12 (December 1, 2023): 2381–88. https://doi.org/10.1038/s41396-023-01548-0.
- **Elia Mascolo***, Satish Adhikari*, Steven M. Caruso, Tagide deCarvalho, Anna Folch Salvador, Joan Serra-Sagristà, Ry Young, Ivan Erill, and Patrick D. Curtis. "The Transcriptional Regulator CtrA Controls Gene Expression in Alphaproteobacteria Phages: Evidence for a Lytic Deferment Pathway." *Frontiers in Microbiology* 13 (August 19, 2022): 918015. https://doi.org/10.3389/fmicb.2022.918015.

Book chapter

- Antonio Frandi, Francesco Pini, Wanassa Beroual, Andrea Bianchetti, Alice Chiodi, **Elia Mascolo**, Lorenzo Miano, Greta Petazzoni, Emanuele G. Biondi, and Matteo Brilli. "Toward a Comparative Systems Biology of the Alphaproteobacterial Cell Cycle." In *Cell Cycle Regulation and Development in Alphaproteobacteria*, edited by Emanuele Biondi, 1–27. Cham: Springer International Publishing, 2022. https://doi.org/10.1007/978-3-030-90621-4_1.

Teaching experience

General and Molecular Genetics (BIOL302 - UMBC) *Spring 2022, Fall 2023, Spring 2024*
>200 students. Designed weekly homework, held weekly office hours, proctored exams.

Ecology and Evolution (BIOL142 - UMBC) *Fall 2021*
>100 students. Prepared and led weekly discussions sections, held weekly office hours, graded and reviewed exams.

Advanced Genomics and Epigenomics (PoliMi-UniMi) *Fall 2022*
Designed, together with Dr. Matteo Brilli, a workshop in R for the class "Advanced Genomics and Epigenomics", delivered by the joint PoliMi-UniMi Master's degree "Bioinformatics for Computational Genomics".

Guest lectures
Guest lecture "Motif matching and motif discovery" for the course Introduction to Bioinformatics and Computational Biology (**BIOL 313 - UMBC**) *Spring 2022, Spring 2023, Spring 2024*

Guest lectures for **high school** students: "Introduction to biology", "The logic of transcription and translation", "Cells and viruses", "Introduction to Genetics" *2022 - 2023*

Mentoring and supervising

Mentoring and supervising research (UMBC) *May 2022 – 2025*
Mentored 4 undergraduate researchers and 2 graduate (MS thesis) students conducting research in the Erill Lab.

Conference presentations

- Talk at EvoKE 2025: Elia Mascolo and Yseult Héjja-Brichard.
  "Replicards: teaching evolution with a card game". *Nov 6-8, 2025 - Athens, Greece*
- Poster presentation at ISMB 2024 (Intelligent Systems for Molecular Biology)
  Elia Mascolo and Ivan Erill. "Molecular Information Theory of Composite Sequence Motifs". *F1000Research* (2024). https://doi.org/10.7490/f1000research.1120047.1 *Jul 12-16, 2024 – Montréal, Canada*
- Talk in the main track of the 2022 Molecular Genetics of Bacteria and Phages Meeting
  "Phage Gene Regulation by CtrA: Evidence for a Lytic Deferment Pathway in Alphaproteobacteria phages". *Aug 1-5, 2022 - Madison, Wisconsin*

Other academic presentations

- Seminar at the Institute of Science and Technology (ISTA)
  "Evolution of Information in Transcriptional Regulatory Systems" *Feb 12, 2025*
- Seminar for the course "Advanced genomics and epigenomics" (PoliMi-UniMi)
  "Evolution of Information in Transcriptional Regulatory Systems" *Dec 11, 2024*
- Seminar at the Department of Biological Sciences (UMBC)
  "Evolution of Transcriptional Regulatory Systems in Prokaryotes" *Oct 16, 2024*
- Presentation at the Research Seminar in Molecular Biology (BIOL770 - UMBC)
  "Overlapping Codes on Nucleotide Sequences" *May 6, 2022*
- Presentation at the Follenzi Lab (UPO)
  "Designing a synthetic enhancer specific for LSEC cells" *Jul 2, 2021*

Grants and fellowships

Research funding

- 2025-2029: "Apart-USA" fellowship awarded by AAS and ISTA
- 2024-2025: Merck-CNMS academic fellowship program at UMBC
- 2022-2023: Merck-CNMS academic fellowship program at UMBC

Grants and awards

- 2024: Travel grant from UMBC Graduate Student Association to attend the *Intelligent Systems for Molecular Biology* conference in Montréal, Canada.
- 2024: *Best poster award* at the Graduate Association of Biological Sciences (GABS) Symposium 2024
- 2023: *Best poster award* at the Graduate Association of Biological Sciences (GABS) Symposium 2023
- 2022: Travel grant from UMBC Graduate Student Association to attend the *Molecular Genetics of Bacteria and Phages Meeting* in Madison, Wisconsin.

Professional memberships

EvoKE (Evolutionary Knowledge for Everyone)
ISCB (International Society for Computational Biology)

Science communication

- Invited talk for high school students at *Melzo Incontra la Scienza* (Melzo meets Science) — *Melzo, Italy*
  "Evolution of Mutation Rates" — *Jan 22, 2025*
- Invited talk for Euresis association — *Rimini, Italy*
  "*Good at evolving* – The Evolution of Mutation Rates" — *Aug 20, 2024*
- Invited talk at Balticon — *Baltimore, USA*
  "Stranger Things of the Microcosmos" — *May 26, 2024*
- Invited talk "Viruses may have eyes and ears on us" at QuantumPhotonics Club podcast — *Oct 29, 2022*
- Online presentations for the general public (local cultural associations) during the lockdown in Italy to explain how COVID-19 vaccines work and how they are developed (> 100 attendees). — *Jan 2021*

Other classes attended

- At the Mathematics Department at UniMi: *Algebra 1*, *Geometry 1*, *Methods and Models for the applications (an introduction to dynamical systems)*, *Biomathematics*.
- At the Computer Science Department at UniMi: *Bioinformatics*, *Principles and Models of Perception*.

Other education

I worked as a jazz piano player in small groups as well as in an orchestra. I participated in the summer workshops of the *Siena Jazz* Academy, earning a scholarship in 2013 as "Best piano student".