MATTEO OSELLA

Department of Physics, University of Torino, Italy.
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EDUCATION

- **PhD in Complex Systems for Life Sciences**, University of Torino, Italy. **December 2010**
  - **Advisor:** Michele Caselle
- **Master in Theoretical Physics**, University of Torino, Italy. **April 2007**
  - **Grade:** 110/110 cum laude
  - **Advisor:** Michele Caselle
- **Bachelor in Physics**, University of Torino, Italy. **October 2004**
  - **Grade:** 110/110 cum laude
  - **Advisor:** Lorenzo Fatibene

HABILITATION

- **September 12, 2018**
  Italian National Scientific Habilitation as Associate Professor in Applied Physics (02/D1 II Fascia)

PROFESSIONAL EXPERIENCE

- **July 2022 - current** Associate Professor.
  Department of Physics, University of Torino, Italy.
- **July 2019 - current** Assistant Professor (RTDb).
  Department of Physics, University of Torino, Italy.
- **June 2018 - July 2019** Assistant Professor (RTDa).
  Department of Physics, University of Torino, Italy.
- **June 2017 - May 2018** Postdoctoral fellow.
  INFN researcher at the Department of Physics, University of Torino, Italy.
- **February 2017 - May 2017** Postdoctoral fellow.
  IFOM, FIRC Institute of Molecular Oncology, Milano, Italy.
- **September 2013 - December 2016** Postdoctoral fellow.
  Department of Physics, University of Torino, Italy
  Supervisor: Michele Caselle.
- **February 2011 - July 2013** Postdoctoral fellow.
  Genomic physics group, CNRS - University Pierre et Marie Curie, Paris, France.
  Supervisor: Marco Cosentino Lagomarsino.
- **January 2008 - December 2010** Doctoral fellow.
  Department of Physics, University of Torino, Italy.
  Supervisor: Michele Caselle.
- **September 2007 - January 2008** Middle school teacher of math and science.
  Scuola Media Schiapparelli, Savigliano (CN), Italy.

PUBLICATIONS

Google scholar: https://scholar.google.it/citations?user=w6RR4jsAAAAJ

1. Entropic contributions to the splicing process.
   Osella M, Caselle M.
   Physical Biology 2009. 24;6(4):046018.
2. The role of incoherent microRNA-mediated feedforward loops in noise buffering.
   Osella M, Bosia C, Corà D, Caselle M.
   PLoS Computational Biology 2011. 7(3):e1001101.
3. A curated database of miRNA mediated feed-forward loops involving MYC as master regulator.
   El Baroudi M, Corà D, Bosia C, Osella M, Caselle M.
   PLoS ONE 2011. 6(3):e14742.
4. NuST: analysis of the interplay between nucleoid organization and gene expression.
   Scolari VF, Zarei M, Osella M, Cosentino Lagomarsino M.
   Bioinformatics 2012. 28(12):1643-4.
5. Gene autoregulation via intronic microRNAs and its functions.
   Bosia C*, Osella M*, El Baroudi M, Corà D, Caselle M. (*=equal contribution)
   BMC Systems Biology 2012. 6(1):131.
6. Growth-rate-dependent dynamics of a bacterial genetic oscillator.
   Osella M, Cosentino Lagomarsino M.
   Physical Review E 2013. 87:012726.
7. Concerted control of *E. coli* cell division.
   Osella M, Nuggent E, Cosentino Lagomarsino M.
   Proceedings of the National Academy of Sciences USA 2014. 111(9):3431-5.
8. Interplay of microRNA and epigenetic regulation in the human regulatory network.
   Osella M, Riba A, Testori A, Corá D, Caselle M.
   Frontiers in Genetics 2014. 5:345
9. Speed of evolution in large asexual populations with diminishing returns.
   Fumagalli MR, Osella M, Thomen P, Heslot F, Cosentino Lagomarsino M.
   Journal of Theoretical Biology 2015. 365:23-31.
10. Stochasticity and homeostasis in the *E. coli* replication and division cycle.
    Adiciptaningrum A, Osella M, Moolman C, Cosentino Lagomarsino M, Tans SJ.
    Scientific Reports 2015. 5:18261.
11. Individuality and universality in the growth-division laws of single *E. coli* cells.
    Kennard AS, Osella M, Javer A, Grilli J, Nghe P, Tans SJ, Cicuta P, Cosentino Lagomarsino M.
    Physical Review E 2016. 93:012408.
12. Stochastic timing in gene expression for simple regulatory strategies.
    Dal Co A, Cosentino Lagomarsino M, Caselle M, Osella M.
    Nucleic Acids Research 2017. 45(3):1069-1078.
13. Step by Step, Cell by Cell: Quantification of the Bacterial Cell Cycle.
    Osella M, Tans SJ, Cosentino Lagomarsino M.
    Trends in Microbiology, 2017. pii: S0966-842X(16)30200-1.

14. Relevant parameters in models of cell division control.
Grilli J, Osella M, Kennard AS, Cosentino Lagomarsino M.
Physical Review E 2017. 95(3-1):032411.

15. Modelling the evolution of transcription factor binding preferences in complex eukaryotes.
Rosanova A, Colliva A, Osella M, Caselle M.
Scientific Reports 2017. 7(1):7596.

16. Statistics of shared components in complex component systems.
Mazzolini A, Gherardi M, Caselle M, Cosentino Lagomarsino M, Osella M.
Physical Review X 2018. 8 (2): 021023.

17. The empirical fluctuation pattern of *E. coli* division control.
Grilli J, Cadart C, Micali G, Osella M, Cosentino Lagomarsino M.
Frontiers in Microbiology 2018. 9, 1541.

18. Zipf and Heaps laws from dependency structures in component systems.
Mazzolini A, Grilli J, De Lazzari E, Osella M, Cosentino Lagomarsino M, Gherardi M.
Physical Review E 2018. 8:012315.

19. Dissecting the control mechanisms for DNA replication and cell division in *E. coli*.
Micali G, Grilli J, Marchi J, Osella M, Cosentino Lagomarsino M.
Cell Reports 2018. 16;25(3):761-771.e4.

20. Concurrent processes set *E. coli* cell division.
G Micali G, J Grilli J, Osella M, Cosentino Lagomarsino M.
Science Advances 2018. 7;4(11).

21. Biophysical analysis of miRNA-dependent gene regulation.
Riba A, Osella M, Caselle M, Zavolan M.
Chapter of book "Systems Biology" pag. 257–273, 2018, Springer International Publishing.

22. Heaps' law, statistics of shared components and temporal patterns from a sample-space-reducing process.
A Mazzolini, A Colliva, M Caselle, M Osella.
Physical Review E 2018. 98:052139.

23. Investigating the epi-miRNome: identification of epi-miRNAs using transfection experiments
E Reale, D Taverna, L Cantini, L Martignetti, M Osella, CD Pitt, F Virga, Francesca Orso, Michele Caselle
Epigenomics 2019 11:14, 1581-1599.

24. A model-driven quantitative analysis of retrotransposon distributions in the human genome
A Riba, MR Fumagalli, M Caselle, M Osella *Genome biology and evolution* 2020 12 (11), 2045-2059.

25. A Topic Modeling Analysis of TCGA Breast and Lung Cancer Transcriptomic Data
F Valle, M Osella, M Caselle
Cancers 2020 12 (12), 3799.

26. Initial cell density encodes proliferative potential in cancer cell populations
CE Bena, M Del Giudice, A Grob, T Gueudré, M Miotto, D Gialama, M Osella, E Turco, F Ceroni, ADe Martino, C Bosia
Scientific reports 2021 11 (1), 1-11

27. The dynamics of aerotaxis in a simple eukaryotic model
M Biondo, C Panuzzo, SM Ali, M Osella, S Bozzaro, E Bracco, B Pergolizzi
Frontiers in cell and developmental biology, 2021, 3100.

28. The impact of whole genome duplications on the human gene regulatory networks
F Mottes, C Villa, M Osella, M Caselle
PLoS Computational Biology, 2021, 17 (12), e1009638

29. Multi-omics Topic Modeling for Breast Cancer Classification
F Valle, M Osella, M Caselle
Cancers 2022, 14 (5), 1150

30. Protein degradation sets the fraction of active ribosomes at vanishing growth
L Calabrese, J Grilli, M Osella, CP Kempes, MC Lagomarsino, L Ciandrini
PLoS Computational Biology 2022, 18 (5), e1010059

31. A 3D transcriptomics atlas of the mouse nose sheds light on the anatomical logic of smell
MLRT Segura, E Abou Moussa, E Garabello, TS Nakahara, M Makhlou,LS Mathew, F Valle, SSY Huang, JD Mainland, M Caselle, M Osella, S Lorenz, J Reisert, DW Logan, B Malnic, A Scialdone, LR Saraiva
Cell Reports 2022, 38 (12), 110547

32. Emergent Statistical Laws in Single-Cell Transcriptomic Data
S Lazzardi, F Valle, A Mazzolini, A Scialdone, M Caselle, M Osella
Physical Review E 2023 107 (4), 044403

33. Out-of-equilibrium gene expression fluctuations in the presence of extrinsic noise
M Biondo, A Singh, M Caselle, M Osella
Physical Biology 2023 20, 056007

34. Inversion dynamics of class manifolds in deep learning reveals tradeoffs underlying generalization
S Ciceri, L Cassani, M Osella, P Rotondo, F Valle, M Gherardi
Nature Machine Intelligence, 2024, https://doi.org/10.1038/s42256-023-00772-9

PREPRINTS

1. The effect of a linear feedback mechanism in a homeostasis model
AF Zirattu, M Biondo, M Osella, M Caselle
arXiv preprint arXiv:2303.03277

STUDENT ADVISING

- Alexis Jacq, BIM project M1, University Pierre et Marie Curie, Paris, France.
  Project: *The effects of gene chromosomal position on regulatory networks in E. Coli.*
- Maria Rita Fumagalli, M.Sc, July 2011, co-supervised with Marco Cosentino Lagomarsino
  University of Milano, Milano, Italy.
  Thesis title: *Stochastic models of evolving bacterial populations under controlled conditions.*
  Grade: 110/110 *cum laude*
- Andrea Cavallone, M.Sc, December 2013, University of Torino, Torino, Italy.
  Thesis title: *Minimal stochastic processes for evolutionary experiments.*
  Grade: 110/110 *cum laude*
- Alma Dal Co, M.Sc, July 2014, University of Torino, Torino, Italy.
  Thesis title: *First-passage time in gene regulatory circuits.*
  Grade: 110/110 *cum laude*
- Ottavia Prunas, B.Sc, October 2014, University of Torino, Torino, Italy.
  Thesis title: *A threshold-crossing problem in stochastic gene expression.*
  Grade: 110/110 *cum laude*
- Maria Chiara Roffin, M.Sc, December 2014, University of Torino, Italy.
  Thesis title: *Size control of E coli cells in different nutrients.*
  Grade: 110/110
- Silvia Semmola, M.Sc, December 2014, University of Torino, Italy.
  Thesis title: *Statistical laws in genome and text composition.*
  Grade: 110/110 *cum laude*
- Andrea Riba, PhD in Complex Systems for Life Sciences, February 2015, University of Torino, Italy.
  Co-supervised with Michele Caselle.
- Bianca Veglia, M.Sc, December 2015, University of Torino, Italy..
  Thesis title : *Fluctuation scaling in genome and text composition.*
  Grade: 110/110
- Valeria Bianchi, M.Sc, December 2015, University of Torino, Italy.
  Thesis title: *The interplay between cell physiology and stochasticity in gene expression.*
  Grade: 110/110 *cum laude*

- Ilaria Iuliani, M.Sc, December 2016, University of Torino, Italy.
  Thesis title: *Interplay between stochastic gene expression and cell cycle in single E. coli cells.*
  Grade: 110/110 *cum laude*
- Antonio Rosanova, PhD in Complex Systems for Life Sciences, March 2017, University of Torino, Italy.
  Co-supervised with Michele Caselle.
- Davide Torredoro, M.Sc, April 2017, University of Torino, Italy.
  Thesis title: *Statistical laws in single-cell RNA sequencing data.*
  Grade: 110/110 *cum laude*
- Andrea Mazzolini, PhD in Complex Systems for Life Sciences, February 2018, University of Torino, Italy.
  Co-supervised with Michele Caselle.
- Marta Biondo, M.Sc., December 2018, University of Torino, Italy.
  Thesis title: *First-passage-time problems in gene expression: the role of extrinsic noise*
  Grade: 110/110 *cum laude*
- Chiara Zappala', M.Sc., December 2018, University of Torino, Italy.
  Thesis title: *Weighted network analysis based on correlations of protein domain families in bacterial genomes*
  Grade: 110/110 *cum laude*
- Thomas Robiglio (co-supervised with G.Petri), B.Sc., July 2021, University of Torino, Italy.
  Thesis title: *Modelli di fenomeni di contagio interagenti su complessi simpliciali*
  Grade: 107/110
- Nicola Pacella (co-supervised with G. Petri), M.Sc., July 2021, University of Torino, Italy.
  Thesis title: *Topological study of the Embeddings obtained with Word2Vec*
  Grade: 110/110 *cum laude*
- Claudio Caprioli, M.Sc., July 2021, University of Torino, Italy.
  Thesis title: *The impact of label granularity in classification problems*
  Grade: 110/110 *cum laude*
- Alessio Borriero, M.Sc., April 2022, University of Torino, Italy.
  Thesis title: *The role of negative examples in classification problems*
  Grade: 110/110 *cum laude*
- Davide Pirovano, M.Sc., April 2022, University of Torino, Italy.
  Thesis title: *The advantage of subclass labelling in classification problems*
  Grade: 110/110 *cum laude*

- Martina Oria, M.Sc., April 2022, University of Torino, Italy.
  Thesis title: *Intrinsic dimension and topological analysis of single-cell RNA sequencing data*
  Grade: 110/110
- Niccol Cirone, M.Sc., April 2022, University of Torino, Italy.
  Thesis title: *Global correlation patterns induced by the Waddington landscape*
  Grade: 110/110 *cum laude*
- Giacomo Amadore, B.Sc., July 2023, University of Torino, Italy.
  Thesis title: *Scaling of intrinsic dimension estimation with the sample size*
  Grade: 110/110
- Mario Baravetto, B.Sc., November 2023, University of Torino, Italy.
  Thesis title: *Data preprocessing strategies for neural recordings*
  Grade: 110/110
- Simone Sciandra, B.Sc., July 2023, University of Torino, Italy.
  Thesis title: *The role of label granularity in the training of neural networks*
  Grade: 110/110 *cum laude*
- Vittorio Garretto, B.Sc., July 2023, University of Torino, Italy.
  Thesis title: *Inversion dynamics of class manifolds in deep learning*
  Grade: 105/110
- Federico Milanesio, M.Sc., July 2023, University of Torino, Italy.
  Thesis title: *Geometric Compression of Internal Representations in Regression problems with Neural Networks*
  Grade: 110/110 *cum laude*

TEACHING

- "Complex Systems" for the interdipartimental program of the "Scuola di Studi Superiori dell'Universita' di Torino", years from 2014/2015 to 2018/2019.
- "Computational Techniques for Physics" 2018/2019 for the Bachelor program in Physics, University of Torino.
- "Machine Learning for Medical Physics" from 2019/2020 to current year for the Medical Physics School, University of Torino.
- "Neural Networks" from 2019/2020 to current year for the Master Degree in Physics, University of Torino.
- "Systems Biology" (part of the course) from 2019/2020 to current year for the Master Degree in Cellular and Molecular Biology, University of Torino.
- "Applied Physics" from 2019/2020 to current year for the "Corso di Laurea in Infermieristica - Cuneo", University of Torino.
- "Deep Learning" from 2022/2023 to current year for the Master Degree in Physics of Complex Systems, University of Torino.

EDITOR - REVIEWER

- Referee for: Nature Communications, Proceedings of the National Academy of Sciences, Physical Review Letters, Communications in Physics, Nucleic Acid Research, Bioinformatics, Journal of Molecular Biology, Methods, Journal of Chemical Physics, Journal of Biosciences, JPhys Complexity, Physica A, Physica D.
- Editorial Board Member of the Nature Partner Journal Systems Biology and Applications.
- Review Editor in Biophysics, part of the journals: Frontiers in Physics, Physiology and Molecular Biosciences.
- External referee for an ERC grant proposal.
- Reviewer for a grant proposal to the MRC (Medical Research Council of UK).
- External Reviewer of 3 PhD thesis for the Politecnico of Torino.

SEMINARS

- "Entropic contributions to the splicing process" invited talk at Systems Biology Mini Symposium, Nice, France, 2009.
- "The role of incoherent microRNA-mediated feedforward loops in noise buffering" contributed talk at BITS (Bioinformatics Italian Society) meeting, Bari, Italy, 2010.
- "Entropic contributions to the splicing process" contributed talk at Italian Biophysical Society meeting, Arcidosso, Italy, 2010.
- "The role of microRNA-mediated circuits in the control of gene expression fluctuations", invited talk at Biozentrum, University of Basel, Switzerland, 2010.
- "The role of microRNA-mediated circuits in the control of gene expression fluctuations", invited talk at Université Pierre et Marie Curie, Paris, France, 2010.

- "Bacterial growth laws and the interplay of physiology and gene expression" invited lectures for the PhD program in "Complex Systems for Life Sciences", University of Torino, Italy, 2012.
- "Cell size control in bacteria" invited lecture for the PhD program in "Complex Systems for Life Sciences", University of Torino, Italy, 2013.
- "Cell size control in E. coli " invited seminar at the Ecole Normale Superieure, Paris, France, 2013.
- "Cell size control in E. coli" invited talk at "Workshop of the Physics of Complex Systems Group", University of Milano, Italy, 2013.
- "Concerted control of E. coli cell division" contributed talk at Quantitative Methods in Gene Reulation II, IOP Conference, Cambridge, UK, 2013.
- "Modelling microRNA regulation and its role in noise buffering" talk as *invited speaker* at the Wellcome Trust Scientific Conference on "Computational RNA Biology", Wellcome Trust Genome Campus, Hinxton, Cambridge, UK, 2014
- "Cell division control in *E. coli*" invited seminar at the Molecular Biotechnology Center, Torino, Italy, 2014.
- "Cell division control in *E. coli*" invited seminar at the Biozentrum, Basel, Switzerland, 2015.
- "Cell division control in *E. coli*" contributed talk at the IOP conference "Physics of Emergent Behaviour II - From molecules to planets", London, UK, 2015.
- "'Modelling microRNA regulation and its role in noise buffering" talk as *invited speaker* at the "Keystone Symposia on Small RNA Silencing: Little Guides, Big Biology", Keystone, Colorado, USA, January 2016
- "Cell division control in *E. coli*" invited seminar at the ICTP, Trieste, Italy, 2016.
- "Cell division control in *E. coli*" seminar at the Meeting Biophys and Pieces, Bari, Italy, 2016.
- "Statistical laws in biological bipartite systems: from genome composition to single-cell gene expression" contributed talk at the "1st qBio mini-Workshop", IFOM, Milano, Italy, 2017.
- " The *E. coli* cell cycle, step by step, cell by cell" invited seminar at Eawag Institute, Zurich, Switzerland, 2017.
- "Statistical laws in complex component systems" invited seminar at the workshop "Regulation and Inference in Biological Networks", Bardonecchia, Italy, 2018.
- "Quantitative characterization of the coordinated processes of cell growth, cell division and DNA replication in *E. coli*" invited seminar at Helmholtz Zentrum, Munich, Germany, 2018.
- "Statistics of shared components in complex component systems" contributed talk at the XXIII National Conference on Statistical Physics and Complex Systems, Parma, Italy, 2018
- "Coordination of Cell Growth, Cell Division and DNA Replication in E. coli". Invited Seminar at the Santa Fe Institue, Santa Fe, USA, 2019

- "Statistical laws in complex component systems". Contributed talk to CCS/Italy 2019 Italian Regional Conference on Complex Systems. Trento, Italy, 2019
- "The intrinsic dimension of cell differentiation". Invited talk at the University of Padova, Italy, 2023
- "First-Passage Time Problems in Gene Expression". Invited talk at the "Alma Dal Co Memorial Symposium", Lausanne, Switzerland, 2023.

CONFERENCE/SEMINAR ORGANIZATION

- Co-organizer of one day of seminars for the PhD program of "Complex Systems for Life Sciences" of the University of Torino, March, 2014.
  Invited speakers: Terence Hwa (UCSD, San Diego, US) and Erik van Nimwegen (Biozentrum, Basel, CH).
- Co-organizer of one day of seminars for the PhD program of "Complex Systems for Life Sciences" of the University of Torino February, 2015.
  Invited speakers: Thomas Hindre (Univ. of Grenoble, France) and Otto X. Cordero (ETH, Zurich, CH)
- Co-organizer of the Workshop/School (Lake Como School of Advanced Studies) on Statistical Physics/Biology "Quantitative Laws II". Como (Italy), June 2016.
  Website: http://qlsb.lakecomoschool.org/.
- Co-organizer of the Workshop " BITS2018-SINGLE-CELL REVOLUTION. Opportunities and challenges in Single-Cell Biology". Satellite of the 15th Annual Meeting of the Bioinformatics Italian Society, Torino, June 2018.
  Website: http://bioinformatics.it/bits2018/1280/bits2018-single-cell-revolution
- Co-organizer of the Workshop "SINGLE-CELL REVOLUTION II" at the Molecular Biotechnology Centre MBC, Torino (Italy). June 2019. Website: https://www.eventbrite.com/e/single-cell-revolution-20-tickets-56471781619
- Co-organizer of the Working group "Aging in single-celled organisms: from bacteria to the whole tree of life" for the Santa Fe Institue, NM, USA. February 2020.
- Co-organizer of the International Physics of Living Systems Annual Meeting held June 3-7, 2024, in Trieste, Italy.

GRANTS

- Grant from Fondazione CRT, Bando Richieste Ordinarie 2022, for the project "GENPHYS: STATISTICAL PHYSICS FOR GENOMIC DATA MINING"; 20k euros