

BIOGRAPHICAL SKETCHNAME: **Monica Ballarino, Ph.D.**

eRA COMMONS USER NAME (credential, e.g., agency login): N/A

POSITION TITLE: **Associate Professor****EDUCATION/TRAINING**

INSTITUTION AND LOCATION	DEGREE	YEARS	FIELD OF STUDY
Consiglio Nazionale delle Ricerche, Rome, Italy	MS	2001	Biology
Sapienza University, Rome, Italy	Ph.D.	2002-2005	Genetics and Molecular Biology
Sapienza University, Rome, Italy	Postdoctoral training	2005-2009	Molecular and Cellular Biology
IGBMC, Strasbourg, France	Research Associate	2009-2012	Epigenetics and Molecular Biology
Sapienza University, Rome, Italy	Tenure-track Researcher	2012-2015	Molecular Biology
Sapienza University, Rome, Italy	Associate Professor	2015-present	Molecular Biology

A. Personal Statement

I specialize in **RNA research**, with a particular focus on how the intrinsic properties of this molecule define the physiological role of non-coding RNAs. My experience in RNA-based regulatory mechanisms began during my master's degree and continued through my doctoral studies in Genetics and Molecular Biology under the mentorship of Prof. Irene Bozzoni. My research has significantly contributed to elucidating the nuclear mechanisms involved in the biosynthesis of **microRNAs**. Thanks to the "Espoirs de la Recherche" fellowship awarded by the Fondation pour la Recherche Médicale, I moved for a post-doctoral internship at the l'Institut de Génétique et de Biologie Moléculaire et Cellulaire in Strasbourg, where I worked in the lab of Prof. Laszlo Tora. My main project focused on identifying a novel molecular circuit that elucidates the role of the onco-miR (miR17) in tumours. During this time, I also served as a visiting scientist at the Ecole Normale Supérieure in Paris, collaborating with Professors Olivier Bensaude and Xavier Darzacq to receive training in single molecule tracking using Fluorescence In Situ Hybridization. Upon my return to Italy as a tenure-track researcher, my research shifted from micro to **long non-coding RNAs**. In collaboration with Anna Tramontano's lab, I pioneered the discovery of novel lncRNA loci, which were previously absent in early gene annotations. Currently, our studies focus on the function of these RNAs through the development and application of dedicated computational pipelines, microscopy techniques and biochemical approaches. Additionally, my lab has substantial expertise in CRISPR-cas9 methodologies, which have been utilized to generate mouse animal models with targeted mutations in specific non-coding loci. The long-term objective of my laboratory is to unravel how the aberrant regulation of lncRNAs affects muscle function in humans, both directly, as observed in skeletal and cardiac muscle diseases, and indirectly, as seen in **neuromuscular disorders**. Recently, we have leveraged genomic editing technologies on induced pluripotent stem cells (iPSCs), which we are now differentiating into various cell types, including skeletal muscle fibres, cardiac cells, and motor neurons. The recent funding from PRIN2022 has enabled us to establish in-house protocols for differentiating iPSCs into **neuromuscular organoids**.

B. Positions, Scientific Appointments, and Honors**Positions and Scientific Appointments**

2024-pres Responsabile area mobilità Erasmus, Facoltà di Farmacia e Medicina, Sapienza University of Rome

2023-pres Deputy Coordinator of the PhD in Genetics and Molecular Biology, Sapienza University of Rome

2022-pres Member of CIVIS-EU University. Experimental Models in Molecular Biomedicine

2022-pres Referent person E-learning platform, Facoltà di Farmacia e Medicina, Sapienza University of Rome

2021-pres Referent person VQR (2015-2019; 2020-2024), Dept. BBDC, Sapienza University of Rome
2020-pres Member of Centro Ricerca e Servizi sperimentazione preclinica, Sapienza University of Rome
2019-pres Associate Professor, BBDC Department, Sapienza University of Rome.

Academic Courses:

MOLECULAR BIOLOGY (CFU:6), Facoltà di Scienze Matematiche Fisiche e Naturali
MOLECULAR BIOLOGY AND GENOMICS (CFU:6), Facoltà di Farmacia e Medicina,
GENOMICA (CFU:3), Facoltà di Scienze Matematiche Fisiche e Naturali
2019-pres Member of Accademia Medica of Rome <https://www.accademiamedicadiroma.it/soci/>
2018-pres Member of Società Italiana di Biofisica e Biologia Molecolare - SIBBM <https://www.sibbm.org/soci>
2017-pres Member of PhD Board in Genetics and Molecular Biology, Sapienza
2016-19 Assistant Professor, BBDC Department, Sapienza University of Rome
2012-15 RTDA researcher, BBDC Department, Sapienza University of Rome
2009-12 Research Associate (Chercheur), Institute de Génétique et de Biologie Moléculaire et Cellulaire, Illkirch-Graffenstanden, Strasbourg, France
2010 Visiting Scientist, Institut de Biologie de l'ENS, Paris, France
2005-09 Post-doctoral training, Sapienza University of Rome
2002-05 Ph.D. fellow, Sapienza University of Rome

Honours

Fellowships and Awards:

2024 ASN 2023/2025. Habilitation Full Professor, 05/E2 - MOLECULAR BIOLOGY
2024 Best poster IIM Meeting 2024, Assisi. Long noncoding RNAs at the interface between muscles and nerves. *Marco Simula*, PhD XXXIX cycle (*)
2024 Best poster SIBBM2024, Trento. The nuclear lncRNA Charmé plays an evolutionarily conserved role in the epigenetic regulation of muscle differentiation. *Giulia Buonaiuto*, PhD XXXVI cycle (*)
2022 FSE – Regione Lazio Contributo premiale per ricercatori
2020 Best PhD Thesis in Genetics and Molecular Biology, Sapienza. Investigating the role of Charmé: a chromatin-associated lncRNA supervisor of mammals myogenesis. *Fabio Desideri*, PhD XXXII cycle (*)
2019 Recognition of "Excellent university teaching", Sapienza University of Rome
2017 FFABR-ANVUR (GU n.297 21-12-2016 Sup Ord n.57), MIUR
2016 Poster Prize XIX CONGRESSO NAZIONALE SIGU, Torino. A new murine long non-coding RNA conserved in human and involved in muscle differentiation. *Rossella Tita*, PhD XXIX cycle (*)
2015-19 ANVUR-VQR Recognition of 3/4 "Excellent-extremely relevant" 1/4 "Excellent" publications
2015 Best Poster, Telethon XVIII Scientific convention, Riva del Garda. RNA-based gene therapy of DMD
2010 Long-Term Fellowship Espoirs de la Recherche "FRM - Fondation pour la Recherche Médicale"
2009 Best Poster, SIROCCO meeting, Hinxton. New connections between miRNA transcription & processing
2005 Premio di Studio Fondazione Telethon
2004 Long-Term fellowship by Istituto Pasteur-Fondazione Cenci-Bolognetti
2003 Short-Term fellowship by Istituto Pasteur-Fondazione Cenci-Bolognetti
2003 Biologist state assessment (150/150). Università degli Studi della Tuscia, Viterbo, ITALY
2002 Long-Term fellowship by Consiglio Nazionale delle Ricerche (CNR), Bando n. 113.50 BO.2

(*) PhD advisor, Monica Ballarino

C. Contributions to Science

Scopus Author Identifier 660372500142, ORCID ID: 0000-0002-8595-7105

Publications in peer-reviewed journals (last 10-years):

- Silvestri B., et al HuD impairs neuromuscular junctions and induces apoptosis in human iPSC and Drosophila ALS models. *Nat Commun.* (2024) Nov 7;15(1):9618. DOI: 10.1038/s41467-024-54004-8.
- Desideri F., et al CyCoNP lncRNA establishes cis and trans RNA-RNA interactions to supervise neuron physiology. *Nucleic Acids Res.* 2024 Sep 9;52(16):9936-9952. DOI: 10.1093/nar/gkae590.
- Taliani, V., et al The long noncoding RNA Charmé supervises cardiomyocyte maturation by controlling cell differentiation programs in the developing heart (2023) *eLife*, 12, art. no. e81360. DOI: 10.7554/elife.81360
- Buonaiuto, G., et al Preparation of Cardiac Extracts from Embryonal Hearts to Capture RNA–protein Interactions by CLIP (2023) *Bio-protocol*, 13 (20), art. no. e4857. DOI: 10.21769/BioProtoc.4857

- Ballarino, M., et al Exploring the landscape of tools and resources for the analysis of long non-coding RNAs (2023) Computational and Structural Biotechnology Journal, 21, pp.4706-471 DOI:10.1016/j.csbj.2023.09.041
- Desideri, F., et al Advances in endogenous RNA pull-down: A straightforward dextran sulfate-based method enhancing RNA recovery (2022) Frontiers in Molecular Biosciences, 9, art.no.1004746. DOI: 10.3389/fmolb.2022.1004746
- Carvelli, A., et al A multifunctional locus controls motor neuron differentiation through short and long noncoding RNAs. (2022) EMBO Journal, 41 (13), art. no. e108918. DOI: 10.15252/embj.2021108918
- Macino, M., et al Targeting the expression of long noncoding rnas in murine satellite cells from single myofibers (2021) Bio-protocol, 11 (21), art. no. e4209. DOI: 10.21769/BioProtoc.4209
- Buonaiuto, G., et al Muscle Regeneration and RNA: New Perspectives for Ancient Molecules (2021) Cells, 10 (10), art. no. 2512. DOI: 10.3390/cells10102512
- Cipriano, A., et al Epigenetic regulation of wnt7b expression by the cis-acting long noncoding rna Inc-rewind in muscle stem cells. (2021) eLife, 10, art. no. e54782, pp. 1-25. DOI: 10.7554/ELIFE.54782
- Santini, T., et al Visualization of nuclear and cytoplasmic long noncoding rnas at single-cell level by rna-fish (2021) Methods in Molecular Biology, 2157, pp. 251-280. DOI: 10.1007/978-1-0716-0664-3_15
- Desideri, F., et al Intronic Determinants Coordinate Charme lncRNA Nuclear Activity through the Interaction with MATR3 and PTBP1 (2020) Cell Reports, 33 (12), art. no. 108548. DOI: 10.1016/j.celrep.2020.108548
- Rea, J., et al HOTAIRM1 regulates neuronal differentiation by modulating NEUROGENIN 2 and the downstream neurogenic cascade. (2020) Cell Death and Disease, 11 (7), art. no. 527. DOI: 10.1038/s41419-020-02738-w ISSN: 20414889
- Martone, J., et al Non-coding RNAs Shaping Muscle (2020) Frontiers in Cell and Developmental Biology, 7, art. no. 394. DOI: 10.3389/fcell.2019.00394
- Pagano, F., et al The noncoding side of cardiac differentiation and regeneration (2020) Current Stem Cell Research and Therapy, 15 (8), pp. 723-738. DOI: 10.2174/1574888X15666200123120249
- Ballarino, M., et al Deficiency in the nuclear long noncoding RNA Charme causes myogenic defects and heart remodeling in mice. (2018) EMBO Journal, 37 (18), art. no. e99697. DOI:10.15252/embj.20189969
- Dimartino, D., et al The Long Non-coding RNA Inc-31 Interacts with Rock1 mRNA and Mediates Its YB-1-Dependent Translation. (2018) Cell Reports, 23 (3), pp. 733-740. DOI: 10.1016/j.celrep.2018.03.101
- Cipriano, A., Ballarino, M. The ever-evolving concept of the gene: The use of RNA/Protein experimental techniques to understand genome functions. (2018) Frontiers in Molecular Biosciences, art.no. 20. DOI: 10.3389/fmolb.2018.00020
- Ribeiro, D.M., et al Protein complex scaffolding predicted as a prevalent function of long non-coding RNAs. (2018) Nucleic Acids Research, 46 (2), pp. 917-928. DOI: 10.1093/nar/gkx1169
- Rosa, A., et al Divergent lncRNAs take the lead on pluripotent cell differentiation (2016) Stem Cell Investigation, 2016 (SEP), art. no. 47. DOI: 10.21037/sci.2016.09.02
- Ballarino, M., et al Non-coding RNAs in muscle differentiation and musculoskeletal disease (2016) Journal of Clinical Investigation, 126 (6), pp. 2021-2030. DOI: 10.1172/JCI84419
- Rosa, A., Ballarino, M. Long Noncoding RNA Regulation of Pluripotency (2016) Stem Cells International, 2016, art.no. 1797692. DOI: 10.1155/2016/1797692
- Morlando, M., et al Long non-coding RNAs: New players in hematopoiesis and leukemia, (2015) Frontiers in Medicine, 2 (APR), art. no. 23. DOI: 10.3389/fmed.2015.00023
- Ballarino, M., et al Novel long noncoding RNAs (lncRNAs) in Myogenesis: A miR-31 overlapping lncRNA transcript controls myoblast differentiation (2015) Molecular and Cellular Biology, 35 (4), pp. 728-736. DOI: 10.1128/MCB.01394-14
- Morlando, M., et al The role of long noncoding RNAs in the epigenetic control of gene expression (2014) ChemMedChem, 9 (3), pp. 505-510. DOI: 10.1002/cmdc.201300569

Submitted manuscripts:

- Grandioso A. et al, "A circuit involving the lncRNA MB3 and the driver genes MYC and OTX2 inhibits apoptosis in Group 3 Medulloblastoma by regulating the TGF- β pathway via HMGN5" Journal of Experimental & Clinical Cancer Research 87e51b2d-e31f-4294-b87d-23a331ce4acf v1.0 *submitted*
- Palma A. et al, "Transcriptional profiling of human brain cortices identifies novel lncRNA-mediated networks dysregulated in amyotrophic lateral sclerosis" HELIYON-D-24-71208 *submitted*
- Buonaiuto G. et al, "Long noncoding RNA HSCHARME is altered in human cardiomyopathies and promotes stem cells-derived cardiomyocyte maturation by splicing regulation" Nat Commun. NCOMMS-24-83523 *under review*

- Palma A. et al, "Genome biology of long non-coding RNAs in humans: a virtual karyotype" Computational and Structural Biotechnology Journal, CSBJ-D-24-01378 *under review*

Publications in the Proceedings of Meetings and Courses (last 5 years, 1st/last author)

- 2024 Simula, Tollis, Buonaiuto, Palma, Durante, Storari, Laneve, Ballarino. Neuromuscular interplay and lncRNAs: a synaptic liason. Regulatory & Non-Coding RNAs, CSHL, NY
- 2024 Buonaiuto, Palma, Simula, Desideri, Santini, Musarò, Ballarino. From mouse to human: how RNA epigenetic influences cardiomyocytes maturation to prevent cardiac hyperplasia - The new cardiobiology, EMBO Workshop 2024, Heidelberg, Germany
- 2023 Palma, Buonaiuto, Montrone, Ballarino. Integration of transcriptomic data to dissect the role of long noncoding RNAs in amyotrophic lateral sclerosis - BITS 2023, Bari, Italy
- 2023 Buonaiuto, Palma, Simula, Desideri, Ballarino. From mouse to human: how RNA epigenetic influences cardiomyocytes maturation - SIBBM 2023 Beyond Genomics: Next Generation Molecular Biology, Bari, Italy
- 2023 Palma, Buonaiuto, Montrone, Ballarino. Integration of transcriptomic data to dissect the role of long noncoding RNAs in amyotrophic lateral sclerosis - SIBBM 2023, Beyond Genomics: Next Generation Molecular Biology, Bari, Italy
- 2023 Floris, Picchio, Cozzolino, Taliani, Buonaiuto, Nicoletti, Ballarino, Pagano, Chimenti. The role of Charme in the phenotype and function of resident cardiac mesenchymal stromal cells. ESC European Society of Cardiology congress Amsterdam - Netherlands
- 2022 Buonaiuto, Taliani, D'Onghia, Desideri, Ballarino. Non-coding RNA-mediated regulation of cardiac development: how RNA epigenetics influences cardiomyocytes maturation, EMBL symposium: The complex life of RNA, Heidelberg, Germany
- 2022 Buonaiuto, Taliani, Desideri, D'Onghia, Bozzoni, Ballarino. LncRNAs in heart development: how RNA epigenetics influences cardiomyocytes maturation to prevent cardiac hyperplasia SIBBM2022: The RNA world 3.0, Rome, Italy
- 2022 Buonaiuto, Taliani, Desideri, Ballarino. From mouse to human: how RNA epigenetic influences cardiac and neuromuscular physiology and disease, National PhD Meeting, Salerno, Italy
- 2022 Desideri, Buonaiuto, Taliani, Bozzoni, Ballarino. Noncoding RNA shaping gene expression: implications in neuromuscular physiopathology, Regulatory & Non-coding RNAs, CSHL, NY
- 2022 Desideri et al, Noncoding RNA shaping gene expression: implications in motor neurons specification, Regulatory & Non-coding RNAs, CSHL, NY
- 2021 Buonaiuto, Taliani, Desideri, Bozzoni, Nicoletti, Musarò, Ballarino. From mouse to human: the nuclear lncRNA Charme as a putative candidate for clinical application? Noncoding RNA World: From Mechanism to Therapy, ncRNA2021
- 2020 Desideri, Buonaiuto, Taliani, Santini, Kasperek, Petrezselyova, Sedlacek, Bozzoni, Ballarino. A comprehensive glimpse on Charme long noncoding RNA, CCP Phenogenomics Conference2020 Vestec, Prague
- 2020 Ballarino. FISHing for Charme, a long noncoding solution to cell differentiation issues, EMBO Practical Course: FISHing for RNAs: Classical to Single Molecule Approaches EMBL Heidelberg, Germany
- 2020 Desideri, Cipriano, Buonaiuto, Santini, Taliani, Petrezselyova, Colantoni, Nicoletti, Musarò, Bozzoni, Ballarino. On the impact of nuclear long noncoding RNAs in myogenesis: Charme interacts with the chromatin to fine-tune muscle specification, 17th Meeting of IIM, Virtual
- 2020 Macino, Cipriano, Buonaiuto, Santini, Biferali, Peruzzi, Colantoni, Mozzetta, Ballarino. Epigenetic regulation of Wnt7b expression by the cis-acting lncRNA lncRewind in muscle stem cells, 17th Meeting of IIM, the Interuniversity Institute of Myology Virtual meeting
- 2020 Taliani, Buonaiuto, Desideri, Cipriano, Santini, Perlas, Nicoletti, Musaro, Bozzoni, Ballarino. Figuring out the role of nuclear lncRNA Charme in muscle development" 9TH international course on non-coding genome, Institut Curie, Paris
- 2019 Desideri, Buonaiuto, Taliani, Cipriano, Calicchio, Bozzoni, Kasperek, Petrezselyova, Sedlacek, Ballarino. LncRNAs fine tune myogenesis: a comprehensive glimpse on Charme, EMBO Symposium: Non-Coding Genome, Heidelberg, Germany
- 2019 Buonaiuto, Desideri, Taliani, Santini, Bozzoni, Ballarino. Deciphering the lncRNAs language in myogenesis: a comprehensive glimpse on Charme, Dip. BBCE, Sapienza, Roma, Italy
- 2019 Desideri, Buonaiuto, Taliani, Cipriano, Calicchio, Bozzoni, Kasperek, Petrezselyova, Sedlacek, Ballarino. Sequence determinants regulating Charme long noncoding RNA epigenetic activities, CCP Phenogenomics Conference2019, Vestec, Prague

- 2019 Buonaiuto, Desideri, Taliani, Santini, Colantoni, Perlas, Nicoletti, Musarò, Bozzoni, Ballarino. Deciphering the lncRNAs language in myogenesis: a comprehensive glimpse on Charme, ShareScience 2019 Sapienza, Roma, Italy.

Invited Presentations

- 2024 Istituti del Polo San Lorenzo, "Lights from the dark matter: noncoding RNAs in neuromuscular physiology and disease", Rome
- 2023 International Winter School, Genome integrity and genome organization in physiology and Pathology, "Myogenesis and long non-coding RNAs: a chromatin affair", Sapienza University of Rome
- 2023 EMBO Course FISHing for RNAs: Classical to Single Molecule Approaches, "FISHing for Charme, a lncRNA solution to cell differentiation issue", EMBL Heidelberg
- 2021 PhD School in Genetics and Molecular Biology, "Methodological issues and challenges for probing the function of long noncoding RNAs", Sapienza University of Rome
- 2021 EMBO Course FISHing for RNAs: Classical to Single Molecule Approaches, "FISHing for Charme, a long noncoding solution to cell differentiation issues", EMBL Heidelberg
- 2020 2nd CCP Phenogenomics Conference "A comprehensive glimpse on Charme long noncoding RNA" Vestec, Prague
- 2019 PhD School in Biology and Molecular Medicine, "A noncoding solution to cell differentiation issues: the Charme example", Sapienza University of Rome
- 2018 SSAS-Scuola Superiore di Studi Avanzati dell'Ateneo "New and improved methodologies to detect RNA/protein interactions with chromatin", Rome
- 2018 EPIGEN Final Meeting. "Non-coding regulation of myogenic chromatin" San Servolo, Venice,
- 2018 SIBBM "When and where: temporal and spatial regulation of biological processes", "Non-coding regulation of myogenic chromatin", Rome
- 2017 Unità di Terapia Intensiva Cardiologica-Ospedale S. Andrea, "Long non coding RNA nella miogenesi e nelle malattie del cuore", Rome
- 2016 Chromatin, Epigenome, Drug discovery, training-school meeting, "Non-coding answers to differentiation questions", Naples
- 2015 Joint meeting People Marie Curie, RNA Day, "LncRNPs and control of chromatin structure" Rome
- 2008 Congres de la Société Française d'Hématologie, "miRNA and hematopoietic differentiation" Paris, France

Scientific Organization

2024 Co-organiser PhD EMBL-Sapienza lectures "Neurobiology and Epigenetics", Sapienza, Rome
 2023 Co-organiser EMBO Practical Course on FISHing for RNAs, EMBL Heidelberg, Germany
 2023 Co-organiser PhD EMBL-Sapienza lectures "Neurobiology and Epigenetics", Sapienza, Rome
 2021 Co-organiser PhD Workshop "Cutting-edge molecular technologies: a Sapienza/EMBL joint effort to share complementary expertise", Sapienza, Rome
 2017 Co-organiser 1st EMBL-Sapienza "Chromatin and Epigenetics" PhD meeting, Sapienza, Rome
 Associate Editor, Frontiers Molecular Bioscience

Editorial activity

Associate Editor, Frontiers Molecular Bioscience
 Review Editor, Frontiers in Genetics; Frontiers in Cell and Developmental Biology
 Reviewer, Nat. Comm; PLoS ONE; Mol.Cell.Biol.; Mol Cell; FEBS; NAR; ARS (issue on "NON-CODING RNAs AND EPIGENETICS")
 Editor of the BBBD Scientific Report <https://bbcd.bio.uniroma1.it/bbcd/archivionotizie/scientific-report-first-edition-2021>