Paula Ramos-Silva, PhD

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I am an evolutionary biologist passionate about **bioinformatics**, **research** and **education**. My enthusiasm for molecular biology and for solving problems using analytical methods has always driven my curiosity and pleasure for sharing scientific knowledge. In my teaching and research, I integrate multiple approaches ranging from molecular biology and microscopy to large-scale **computational analyses** of **genomics**, **transcriptomics** and **proteomics** data, applied to **bacteria** and **animals**.

EMPLOYMENT HISTORY

01/07/2018 - 31/08/2022 **Postdoctoral Researcher**
Affiliations: Plankton Diversity and Evolution Group, Naturalis Biodiversity Center & Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, The Netherlands
Project: Evolution of planktonic gastropod calcification (**EPIC**)
Advisor: Dr. Katja Peijnenburg

01/11/2019 - 30/04/2020 **Maternity Leave** (6 months)

01/03/2014 - 30/04/2018 **Postdoctoral Researcher**
Affiliation: Computational Genomics Group, Instituto Gulbenkian de Ciência, Portugal
Project: Understanding the evolutionary history and the diversity of bacterial endosporulation (**EvoSpore**)
Advisors: Dr. José Pereira-Leal and Dr. Adriano O. Henriques

09/01/2009 - 19/12/2013 **PhD Candidate**
Affiliations: Computational Science Section, University of Amsterdam, The Netherlands & Biogéosciences, University of Burgundy, France
Project: Marie Curie ITN Biomineralization: understanding of basic mechanisms for the design of novel strategies in nanobiotechnology (**BIOMINTEC**)
Promotor: Prof. Peter Sloot
Supervisors: Dr. Jaap Kaandorp and Dr. Frédéric Marin

01/11/2007 - 30/11/2008 **Research Analyst**
Affiliation: Centre of Biological and Chemical Engineering, Instituto Superior Técnico, University of Lisbon, Portugal

EDUCATION

09/01/2009 - 19/12/2013 **PhD in Biology - Bioinformatics**
Informatics Institute, University of Amsterdam, The Netherlands
Thesis: Biocalcification of mollusk shells and coral skeletons. Integrating molecular, proteomics and bioinformatics methods
Link

01/09/2001 - 10/10/2007 **Integrated MSc (BSc + MSc) in Biological Engineering**
Instituto Superior Técnico, University of Lisbon, Portugal &
Faculty of Engineering, Lund University, Sweden
Thesis: Removal of 17β-estradiol from water using molecularly imprinted polyethersulfone microspheres Link

PUBLICATIONS

Peer-reviewed articles

1. Checa AG, Pimentel C, Berent K, Ramos-Silva P, Rodríguez-Navarro AB, Cartwright JHE, Sainz-Díaz CI. Evidence for helical microstructure of aragonite fibers in pteropod shells. **MRS Bulletin** 2022; https://doi.org/10.1557/s43577-022-00418-y

2. Berent K, Cartwright JHE, Checa AG, Pimentel C, Ramos-Silva P, Sainz-Díaz CI. Helical microstructures in molluscan biomineralization are a biological example of close packed helices that may form from a colloidal liquid crystal precursor in a twist–bend nematic phase. **Physical Review Materials** 2022; 105601: 1–9. https://doi.org/10.1103/PhysRevMaterials.6.105601

3. Ramos-Silva P*, Odendaal M-L*, Wall-Palmer D, Mekkes L, Peijnenburg KTCA. Transcriptomic responses of adult versus juvenile atlantids to ocean acidification. **Frontiers in Marine Science**, 2022; 9:801458. (*co-authors) https://doi.org/10.3389/fmars.2022.801458

4. Ramos-Silva P, Wall-Palmer D, Marlétaz F, Marin F, Peijnenburg KTCA. Evolution and biomineralization of pteropod shells. **Journal of Structural Biology**, 2021; 213(4):107779. https://doi.org/10.1016/j.jsb.2021.107779

5. Wall-Palmer D, Mekkes L, Ramos-Silva P, Dämmer LK, Goetze E, Bakker K, Duijm E, Peijnenburg, KTCA. The impacts of past, present and future ocean chemistry on predatory planktonic snails. **Royal Society Open Science**, 2021; 8:202265. https://doi.org/10.1098/rsos.202265

6. Choo LQ, Bal TMP, Choquet M, Smolina I, Ramos-Silva P, Marlétaz F, Kopp, M, Hoarau G, Peijnenburg KTCA. Novel genomic resources for shelled pteropods: a draft genome and target capture probes for *Limacina bulimoides*, tested for cross-species relevance. **BMC Genomics**, 2020; 21(1):11. https://doi.org/10.1186/s12864-019-6372-z

7. Ramos-Silva P, Serrano M, Henriques AO. From root to tips: sporulation evolution and specialization in *Bacillus subtilis* and the intestinal pathogen *Clostridioides difficile*. **Molecular Biology and Evolution**, 2019; 36(12):2714-36. https://doi.org/10.1093/molbev/msz175

8. Le Roy N, Jackson D, Marie B, Ramos-Silva P, Marin F. The evolution of metazoan alpha-carbonic anhydrases and their roles in calcium carbonate biomineralization. **Frontiers in Zoology**, 2014; 11(1):75. https://doi.org/10.1186/s12983-014-0075-8

9. Ramos-Silva P, Kaandorp J, Herbst F, Plasseraud L, Alcaraz G, Stern C, Corneillat M, Guichard N, Durlet C, Luquet G, Marin F. The skeleton of the staghorn coral *Acropora millepora*: molecular and structural characterization. **PLoS One**, 2014; 9(6):e97454. https://doi.org/10.1371/journal.pone.0097454

10. Marin F, Le Roy N, Marie B, Ramos-Silva P, Bundeleva I, Guichard N, Immel F. Metazoan calcium carbonate biomineralizations: macroevolutionary trends–challenges for the coming decade. **Bulletin de la Société Géologique de France**, 2014; 185(4):217-32. https://doi.org/10.2113/gssgfbull.185.4.217

11. Marie B, Ramos-Silva P, Marin F, Marie A. Proteomics of $CaCO_3$ biomineral-associated proteins: how to properly address their analysis. **Proteomics**, 2013; 13(21):3109-16. https://doi.org/10.1002/pmic.201300162

12. Ramos-Silva P, Kaandorp J, Huisman L, Marie B, Zanella-Cléon I, Guichard N, Miller DJ, Marin F. The skeletal proteome of the coral *Acropora millepora*: the evolution of calcification by co-option and domain shuffling. **Molecular Biology and Evolution**, 2013; 30(9):2099-112. https://doi.org/10.1093/molbev/mst109

13. Marie B, Jackson DJ, Ramos-Silva P, Zanella-Cléon I, Guichard N, Marin F. The shell-forming proteome of *Lottia gigantea* reveals both deep conservations and lineage-specific novelties. **The FEBS Journal**, 2013; 280(1):214-32. https://doi.org/10.1111/febs.12062

14. Ramos-Silva P, Benhamada S, Le Roy N, Marie B, Guichard N, Zanella-Cléon I, Plasseraud L, Corneillat M, Alcaraz G, Kaandorp J, Marin F. Novel molluskan biomineralization proteins retrieved from proteomics: a case study with Upsalin. **ChemBioChem**, 2012; 13(7):1067-78. https://doi.org/10.1002/cbic.201100708

Letters and reports

15. Ramos-Silva P, Brito PH, Serrano M, Henriques AO, Pereira-Leal JB. Rethinking the niche of upper-atmosphere bacteria: draft genome sequences of *Bacillus aryabhattai* C765 and *Bacillus aerophilus* C772, isolated from rice fields. **Genome Announcements**, 2015; 3(2): e00094-15. PubMed https://doi.org/10.1128/genomeA.00094-15

16. Ramos-Silva P, Marin F, Kaandorp J, Marie B. Biomineralization toolkit: the importance of sample cleaning prior to the characterization of biomineral proteomes. **Proceedings of the National Academy of Sciences USA**, 2013; 110(24):E2144-6. https://doi.org/10.1073/pnas.1303657110

Book chapters & conference papers

17. Deutekom ES, Konglerd P, Ramos-Silva P, Kaandorp JA. From Molecules to Morphologies, a Multiscale Modeling Approach to Unravel the Complex System of Coral Calcification. The Cnidaria, Past Present and Future, Springer, 2016; pp 223-36. https://doi.org/10.1007/978-3-319-31305-4_14

18. Ramos-Silva P, Marin F. Proteins as functional units of biocalcification - an overview. Biomineralization: From Fundamentals to Biomaterials and Environmental Issues, Key Engineering Materials, 2016; 672:183-90. https://doi.org/10.4028/www.scientific.net/KEM.672.183

19. Le Roy N, Jackson DJ, Marie B, Ramos-Silva P, Marin F. Carbonic anhydrase and metazoan biocalcification: a focus on molluscs. Biomineralization: From Fundamentals to Biomaterials and Environmental Issues, Key Engineering Materials, 2016; 672:151-157. https://doi.org/10.4028/www.scientific.net/KEM.672.151

20. Marin F, Le Roy N, Marie B, Ramos-Silva P, Wolf S, Benhamada S, Guichard N, Immel F. Synthesis of Calcium Carbonate Biological Materials: How Many Proteins are Needed? Bioceramics 25, Key Engineering Materials, 2014; 614:52-61. https://doi.org/10.4028/www.scientific.net/KEM.614.52

21. Marin F, Marie B, Benhamada S, Ramos-Silva P, Le Roy N, Guichard N, Wolf S, Montagnani C, Joubert C, Piquemal D, Saulnier D, Gueguen Y. 'Shellome': proteins involved in mollusc shell biomineralization - diversity, functions. International Symposium on Pearl Research, Terrapub, 2013; pp 149–16. https://hal.archives-ouvertes.fr/hal-00793668

TEACHING

11/2020 - Present	**Guest lecturer** in **bioinformatics** for the course **Biological Oceanography**, MSc level, University of Amsterdam, The Netherlands (~6 hours)
11/2020 - Present	**Teaching assistant** in **laboratory practicals** for the course **Biological Oceanography**, MSc level, University of Amsterdam, The Netherlands (24 hours)
10/2018	**Lecturer** of the module **Computational Biology and Bioinformatics** at the Tirana Mathematical and Computational Biology Workshop, Albania (4 hours)
07/2014 - 07/2015	**Guest lecturer**, **journal club coordinator** and **evaluator** of final presentations for the course **Research in Bioinformatics**, MSc level, University of Lisbon, Portugal (12 hours)
01/2014 - 03/2015	**Lecturer** of **Applied Genetics** and **Statistics**, BSc level, University of the Nouvelle Grand'Anse, Haiti. This teaching was part of a program organized by the NGO Haitian Connection (haitianconnection.org). (140 hours)

SUPERVISION & MENTORING

03/2021 - 06/2022	Gloria Casas Canales MSc Freshwater & Marine Biology, University of Amsterdam Project: Transcriptomic responses of the sub-Antarctic pteropod *Limacina retroversa* to ocean acidification: adults vs juveniles
09/2021 - 10/2021	Héloïse Ribot MSc Science Education and Communication, Utrecht University Project: "Seashells inspire CO_2 storage" - popular science article
05/2020 - 11/2020	Mari-Lee Odendaal MSc Biology, Wageningen University & Research Project: Transcriptomic responses of juvenile versus adult shelled heteropods under decreasing ocean pH
01/2019 - 09/2019	Jack Smith MSc Biology, Leiden University Project: Screening for fast-evolving genes in pteropod species

INVITED TALKS & SEMINARS

03/2022	*'Biomineralization in holoplanktonic gastropods: from genes to shells'* Colloquium Live at Tribune, Naturalis Biodiversity Center, Leiden, The Netherlands
03/2022	'*Pteropod biomineralization – from shell microstructures to proteins'* Marine Genomics & Evolution Symposium, Naturalis Biodiversity Center, Leiden, The Netherlands
07/2019	'*Evolution of planktonic gastropod biomineralization*' Meeting: Understanding biomineralisation and the impact of global change in marine organisms, Institute for Advanced Study, Amsterdam, The Netherlands
10/2018	*'Sporulation from root to tips: evolution in Bacillus subtilis and Clostridioides difficile'* Tirana Mathematical and Computational Biology Workshop, Tirana, Albania
10/2013	*'On biomineralization of mollusk shells and coral skeletons'* Research Seminar, Thomas E. Starzl Transplantation Institute, University of Pittsburgh, USA

CONFERENCE PRESENTATIONS

06/2022 Meeting of the Netherlands Society for Evolutionary Biology, Ede, The Netherlands
03/2022 Ocean Sciences Meeting, Hawaii, virtual
09/2019 15th International Symposium on Biomineralization, Munich, Germany
04/2019 Poster pitch at The Conference of the Netherlands Society for Evolutionary Biology, Ede, The Netherlands
08/2013 12th International Symposium on Biomineralization, Freiberg, Germany
08/2013 5th Meeting - COST Action Biomineralix, Bologna, Italy
09/2012 4th Meeting - COST Action Biomineralix, Aarhus, Denmark
02/2011 Biomintec International Workshop - Molecular Biomineralization in Marine Organisms: Nanobiotecnology and Biomedical Applications, Palermo, Italy,
06/2010 French Conference on Biology of the Mineralized Tissues (12èmes JFBTM), Saint Étienne, France
04/2010 7th International Symposium on Networks in Bioinformatics (ISNB 2010), Amsterdam, The Netherlands

CONFERENCE POSTERS

09/2019 Pearls of Wisdom: synergising leadership and expertise in molluscan genomics, Kavli Royal Society Centre, Chicheley Hall, UK
05/2019 NWO Life Congress, Bunnik, The Netherlands
04/2019 Meeting of the Netherlands Society for Evolutionary Biology, Ede, The Netherlands
08/2017 16th Congress of the European Society for Evolutionary Biology, Groningen, The Netherlands
12/2010 Euro ISRS symposium, Wageningen, The Netherlands
07/2010 French Conference on Biology, Computer Science and Mathematics (JOBIM 2010), Montpellier, France

PERSONAL GRANTS

02/2019 Marie Skłodowska-Curie Individual Fellowship
Project: **EPIC** - Evolution of planktonic gastropod calcification,
Grant No.: 844345
Funding Source: European Commission
Amount and duration: 176k €, 2.5 years
Host: Naturalis Biodiversity Center

02/2015 FCT Postdoctoral Fellowship
Project: **EvoSpore** - Understanding the evolutionary history and the diversity of bacterial endosporulation
Funding Source: Portuguese Foundation for Science and Technology – FCT
Grant No.: SFRH/BPD/103171/2014
Amount and duration: 55k €, 3 years
Host: Instituto Gulbenkian de Ciência

AWARDS

01/2019 Travel Award by the Malacological Society of London for the project '**Shell structures of three pelagic mollusks**', UK
05/2017 2nd Martin Fellowship by Naturalis Biodiversity Center for the project **'Shell proteomes in planktonic gastropods'**, The Netherlands
02/2017 Award by The Society of Molecular Biology and Evolution for the SMBE 2017 with the presentation '**Tracing endosporulation evolution: the ancestral genes and lineage specific novelties**', USA (declined)
10/2016 1st Martin Fellowship by Naturalis Biodiversity Center for the project **'Biomineralization genes in planktonic gastropods'**, The Netherlands

07/2013 Scholarship Award from the National Institutes of Health & Howard Hughes Institute for the course '**Frontiers in Stem Cells & Regeneration'**, USA
02/2007 ERASMUS Scholarship by the University of Lisbon for **MSc research project** in **Bioremediation** at the Faculty of Engineering, Lund University, Sweden

CERTIFICATIONS & TRAINING

In bioinformatics

03/2022 Genome Assembly and Annotation, physalia-courses.org (online)
11/2021 Ecological and Evolutionary Studies on DNA Methylation in Plants and Animals, physalia-courses.org (online)

I participated in six intensive courses organized by The Gulbenkian Training Program in Bioinformatics (gtpb.igc.gulbenkian.pt):

04/2018 Analysis of Differential Expression with RNAseq
04/2017 Advanced Biostatistics for Bioinformatics Tool Users using R
03/2017 Population Genetics and Demographic History: model-based approaches
03/2016 NGS Data Analysis, RNAseq, ChIPseq
11/2014 Bioinformatics using Python for Biologists
10/2014 Transcriptome Analysis, Automatic Function Annotation and Data Mining

Others

04/2022 Didactical modules 1-3 and 6, Teaching and Learning Centre FNWI, University of Amsterdam
11/2020 EMBO Lab Leadership course for Postdocs by embo.org
07/2016 eLife Workshop on Peer Review
08/2015 PADI Open Water Diver
04/2014 Biosafety Levels 2 and 3, Instituto Gulbenkian de Ciência
09/2013 Frontiers in Stem Cells & Regeneration, Marine Biological Laboratory, Woods Hole, MA, USA

PEER-REVIEW

Scientific Reports, Frontiers in Genetics, Genome Biology and Evolution, Journal of Proteome Research, Plos One, F1000Research

SOCIETY MEMBERSHIPS

2017-Present Society for Molecular Biology and Evolution (SMBE)
2019-Present Netherlands Society for Evolutionary Biology (NLSEB)

OUTREACH

09/2022 Spotlight: 'The amazing shells of sea butterflies' in the LiveScience showroom at Naturalis Biodiversity Center

09/2021 Promotional video of the publication *Evolution and biomineralization of pteropod shells* in collaboration with VJs from Studio de Maan

08/2019 "Shell microstructures of planktonic gastropods" in the Bulletin of The Malacological Society of London Nr 73, The Malacologist (ISSN 1759-1406)

2014-17 I participated in several microscope demonstrations, science games and one-on-one speed dates about computational biology, bioinformatics, genes and evolution at the annual NOS Alive Music Festival, Lisbon, Portugal

10/2016 Open Day at the Instituto Gulbenkian de Ciência - I participated in this event by creating an interactive game introducing evolutionary thinking to children and teenagers named "How are animals related?", Oeiras, Portugal

01/2015 I presented 'A mobility experience' to share my experience living and working abroad as a PhD candidate to the students of the University of Trás-os-Montes and Alto Douro (UTAD), during the EURAXESS Roadshow in Vila Real, Portugal

09/2012 Radio interview for the programme "Portuguese in the World", Antena 1, to share my experience in France and The Netherlands and explain my research in biomineralization.

ACADEMIC SERVICES

09/2022-Present Expert Evaluator and Rapporteur of Marie Skłodowska-Curie postdoctoral proposals for the European Commission

05/2021-Present Manager of the high memory server for the Plankton Diversity and Evolution group at Naturalis. Tasks: bridge between researchers and IT unit, maintain system up to date, write documentation install/update software, manage user accounts, technical support to users

05/2017-05/2018 Manager of the high memory server from the Computational Genomics Laboratory at Instituto Gulbenkian de Ciência. Tasks: maintain system up to date, install software, manage user accounts, technical support to users, install and manage a graphical interface to access the server

11/2014-10/2015 Postdoc Committee member, Instituto Gulbenkian de Ciência, Portugal
Main roles:

- Organizer of the monthly Careers in Science Seminar Series.
- Organizer of 2nd Annual Joint Postdoctoral Meeting, Setúbal, Portugal, November 4-6, 2015 with approx. 100 participants
- Postdocs' spokesperson

SKILLS

- **Programming/Scripting**: R, Python, bash, sh, RMarkdown, Quarto, RStudio, Git, PyCharm, SLURM, Snakemake, UNIX
- **Bioinformatics**: RNAseq, genome and transcriptome sequencing, sequence alignments, blast, phylogenetics (Bayesian, ML, MEGA), orthology/paralogy (bi-directional blast, COG, OrthoMCL), ancestral reconstruction, differential gene expression (edgeR, DESeq), proteomics, protein structure (AlphaFold, Modeller, Chimera), biological databases (PFAM, NCBI, UniproKB, InterProScan, KEGG), functional annotation (Trinotate), Galaxy server, Bioconductor, BioPython, BioPerl.
- **Molecular Biology**: DNA/RNA/Protein extractions, PCR (basic, real-time, 3' 5' race), DNA cloning, library preparations for Illumina platforms
- **Biochemistry**: SDS PAGE, protein assays
- **Microbiology**: Bacterial culturing (plate and microbioreactors)
- **Microscopy**: resin embedding and other preparations for Scanning Electron Microscopy

LANGUAGES

Portuguese (native), English (full - C2*), French (full – C2*), Dutch (limited – B1*)
* Levels according to the Common European Framework of Reference