

Part A. PERSONAL INFORMATION

First and Family name	Marco Polin		
Passport	YA0720175 (ITA)	Age	47
Researcher codes	WoS Researcher ID (*)	H-4202-2011	
	ORCID Code	0000-0002-0623-3046	

A.1. Current position

Employing entity	IMEDEA (UIB-CSIC)		
Department	Marine Ecology & Physics		
Address and Country	Miquel Marques, 21, 07190, Esporles, Illes Balears		
Phone number	971611910	E-mail	mpolin@imedea.uib-csic.es
Current position	Investigador Científico CSIC	From	01/10/2023

A.2. Previous positions (research activity interruptions, art. 13.2.b))

Period	Position/Institution/Country/Interruption cause
2023-2023	PCD I3/IMEDEA-U. de les Illes Balears/Spain/Moved to CSIC
2020-2023	Ramón y Cajal Researcher/IMEDEA/Spain/moved to permanent job
2018-2020	Associate Professor/Physics Dept. U. Warwick/UK/held until move to Spain
2016-2020	Group Leader Centre for Mechanochemical Cell Biology/University of Warwick/UK/held until move to Spain
2013-2018	Assistant Professor/Physics Dept. U. Warwick/UK/held until promotion
2013-2013	Postdoctoral researcher/University of Cambridge/UK/moved to independent position
2010-2013	EPSRC Cross-Disciplinary Postdoctoral Fellowship/University of Cambridge/UK/fellowship ended
2008-2010	MSCA Intra European Fellowship/U. Cambridge/UK/fellowship ended
2007-2008	Postdoctoral researcher/University of Cambridge/UK/moved to fellowship

A.3. Education

Title	University	Year
MsC in Physics	University of Padova (ITA)	1999
PhD in Physics	New York University (NY, USA)	2007

Part B. CV Summary

My lab uses experimental and theoretical tools from physics to advance our understanding of microorganisms, the most abundant and varied group of living organisms. We are particularly interested in their motility, their response to physico-chemical environmental stimuli, the connection between motility and metabolism and their behaviour as active-matter.

After my Laurea (MSc; 110/110 cum laude) in Theoretical Physics at the University of Padova (Italy) I moved for a PhD at the Centre for Soft Matter Research, New York University (USA), in the group of Prof. David Grier, a pioneer in optical tweezers. I was trained in theoretical and experimental soft matter and optics, and contributed to technological development (US Patent 20090101807) which enabled me to investigate fundamental colloidal interactions (hydrodynamic, light-induced, electrostatic; 6 articles incl. 2 PRL). Meanwhile, I also worked on Potts model Monte Carlo simulations with another group (PRL; J. Stat Phys.). My PhD at NYU was co-financed by a Dean's Dissertation Fellowship.

I then moved to the Department of Applied Mathematics of the University of Cambridge (Marie-Curie Fellow and then as EPSRC Fellow) in the group of Prof. Raymond Goldstein. There I developed an interest in the role of physical forces in microbiology, and the insights offered in this area by quantitative dynamical models. I trained in microbial wetlab techniques, cell biology, microhydrodynamics, dynamical systems. My research in Cambridge focussed on cell motility and the dynamics of eukaryotic flagella, micrometric whip-like active filaments common to most eukaryotic species, including humans. I spearheaded a new line of research into flagellar coordination which led to important discoveries on flagellar dynamics, their intrinsic biochemical noise, and the resulting cell motility (1 Science; 3 PRLs). I discovered the simplest known organism displaying large-scale ciliary coordination (like in humans), characterised its dynamics and developed a model for it (1 PRL). I performed the first measurement of microbial flow fields (1 PRL), and helped discover how flagella modify interactions between microbes and surfaces (1 PNAS).



In Sept 2013 I moved to Warwick's Physics Department, first as an Assistant Professor then promoted to **Associate Professor** in 2018. I have been **Group Leader** in Mechanochemistry since 2017. In 2020 I moved as a **Ramón y Cajal** Fellow to the Mediterranean Institute for Advanced Studies (IMEDEA UIB-CSIC) where I have a joint appointment with the Physics Department of the University of the Balearic Island. In February 2023 I moved to a PCD I3 position (Tenured Lecturer) at UIB. In October 2023 I moved to the Spanish National Research Council (CSIC) as **Investigador Científico**.

My group produced publications in top journals (Nat. Com.; PRL; eLife; Sci. Rep.; Roy. Soc. Interface), and latest research expanded greatly beyond flagella, from physics of active suspensions to motility under confinement, to motility and cell metabolism. The group **currently includes 2 PDRAs, 2 PhD students and 1 Technician**. In the past I supervised **3 PDRAs** (on to: 1.CNRS Researcher at ENS Paris; 2.Maitre de Conf. at U. Bordeaux; 3.PDRA at U. Tokyo); **5 PhDs** (on to: 1.Sys Eng. at Refeyn; PDRAs at 2.Tufts Uni., 3.U. Oxford, 4.Crick Inst. London, 5.U. California Merced); **1 MSc by Research**.

My research is often collaborative, and current projects include both international and national collaborations with mathematicians, physicists, biologists. I have received **14 awards** (grants/fellowships), of which 11 as PI with >€1.7M of total value.

I am an active member of the scientific community. Since 2013 I have given >30 invited talks at conferences/meetings/seminar series in Australia, France, Italy, Denmark, Germany, Portugal, The Netherlands, Switzerland, and the UK. I have been invited to write a "Viewpoint" in APS Physics, and a "News and Views" article for Nature. I regularly review papers for major journals (incl. Nature, Nat. Com., eLife, PNAS, PRX, PRL), and have refereed grants for the ERC (StG and CoG), The Royal Society, UKRI (BBSRC, EPSRC), the French ANR, the Israeli ISF, the Swiss NSF.

I obtained an I3 certification from the Ministerio de Universidades, 3 sexenios (ANECA), qualifications as Titular de Universidad in Science (ANECA), PCD in Science and in Engineering (AQUIB), Associate Professor Abil. (Italian Ministero dell'Istruzione e Ricerca).

As a scientist, I recognise the importance to engage the general public and promote science and scientific research. As a result, over the years I have participated in outreach activities (tot. 20) which ranged from public lectures, to Open Days, to hosting primary and high-school classes, mature students, ethnic minority students, and students' work placement. I am currently the **coordinator of a 2-years Horizon Europe MSCA-CITIZENS** outreach project (OceanNight) pulling together 5 CSIC institutes to promote interdisciplinary public knowledge related to marine science. Outreach complements my extensive teaching activity, for which I obtained a Postgraduate Certificate in Academic and Professional Practice (2-years part-time course, recognised by the UK Higher Education Academy). My **teaching** covers graduate and undergraduate modules (since 2013: 15 UG and 8 Grad modules; UWarwick ~500hrs, UCam ~20hrs; NYU~100hrs), as well as small-group tutorials (tot. 25 students so far), and it extends back to my PhD years.

Part C. RELEVANT MERITS

C.1. Publications (including books). Overall at a glance: 36 publications; tot cit. 3483 (GScholar; 2190 cit. WoS); 95% in Q1, 67% >95th percentile; h=24 (GScholar; 21 WoS); i10=33. **Publications since 2013 (in red the 10 most relevant)**

- 1.L.S. Mosby, A. Straube, **M. Polin(AC)**. "A General Model for the Motion of Multivalent Cargo Interacting with Substrates." *J. Roy. Soc. Interface* 20, 20230510 (2023).
- 2.N. Araujo *et al.* "Steering self organisation through confinement" *Soft Matt.* 19,1695 (2023).
- 3.I.Lopez-Grobas, M. Asally, M. Polin. "The dynamics of single-to-multi layer transition in bacterial swarms." *Frontiers in Soft Matter*, 2, 936779 (2022).
- 4.S. Williams, R. Jeanneret, I. Tuval, and **M. Polin(AC)**. "Confinement-induced accumulation and de-mixing of microscopic active-passive mixtures." *Nat. Commun.*, 13, 4776 (2022).
- 5.M. Latva, C. Dedman, R. Wright, M. Polin, and J. A. Christie-Oleza. "Microbial pioneers of plastic colonisation in coastal seawaters." *Marine Pollution Bulletin*, 179, 113701 (2022).
- 6.M. Souzy, A. Allard, J.F. Louf, M. Contino, I. Tuval, and M. Polin. "Microbial narrow-escape is facilitated by wall interactions." *Phys. Rev. Res.* 4, L022029 (2022).
7. M. del Mar Aguilo-Ferretjans, R. Bosch, R. J. Puxty, M. Latva, V. Zadjelovic, A. Chhun, D. Sousoni, M. Polin, D. J. Scanlan, and J. A. Christie-Oleza(AC). "Pili allow dominant marine cyanobacteria to avoid sinking and evade predation." *Nat. Commun.* 12, 1857 (2021).
- 8.I. Lopez-Grobas, **M. Polin(AC)***, and M. Asally(AC)*. "Swarming bacteria undergo localized dynamic phase transition to form stress-induced biofilms."(*Joint last auth.) *eLife* 10, e62632 (2021).



- 9.A. Javadi, J. Arrieta, I. Tuval, and M. Polin. "Photo-bioconvection: towards light-control of flows in active suspensions". *Phil. Trans. Roy. Soc. A* 378, 20190523 (2020).
- 10.L. Mosby, M. Polin, and D. V. Koester. "A Python based automated tracking routine for myosin II filaments". *J. Phys. D: Appl. Phys.* 53, 304002 (2020).
- 11.L. Mosby, N. Hundt, G. C. Young, A. Fineberg, M. Polin, S. Mayor, P. Kukura, and D. V. Koester. "Visualization of myosin II filament dynamics in remodeling acto-myosin networks with interferometric scattering microscopy". *Biophys. J.* 118, 1-12 (2020).
- 12.R. Jeanneret, M. Pushkin and M. Polin(AC). "Topological sensitivity of microbial flow fields under tight confinement." *Phys. Rev. Lett.* 123, 248102 (2019).
- 13.J. Arrieta(AC), M. Polin(AC), R. Saleta-Piersanti and I. Tuval(AC). "Light Control of Localised Photo-Bio-Convection." *Phys. Rev. Lett.* 123, 158101 (2019). (Authors in alphabetical order).
- 14.Y. Liu, R. Claydon, M. Polin*, and D. R. Brumley*. "Transitions in synchronization states of model cilia through basal-connection coupling." (*Joint last auth.) *J. Roy. Soc. Interface* 15:20180450 (2018).
- 15.A. Mathijssen, R. Jeanneret and M. Polin. "Universal entrainment mechanism governs contact times with motile cells." *Phys. Rev. Fluids*, 3:033103 (2018).
- 16.J. Arrieta, A. Barreira, M. Chioccioli, M. Polin(AC), and I. Tuval(AC). "Phototaxis beyond turning: persistent accumulation and response acclimation of the micro alga *Chlamydomonas reinhardtii*." *Sci. Rep.* 7:3447 (2017).
- 17.D.R. Brumley, N. Bruot, J. Kotar, R.E. Goldstein, P. Cicuta, and M. Polin(AC). "Long-range interactions, wobbles and phase defects in chains of fluid-coupled oscillators." *Phys. Rev. Fluids* 1:081201(R) (2016).
- 18.R. Jeanneret, M. Contino, and M. Polin. "A brief introduction to the model microswimmer *Chlamydomonas reinhardtii*." *EPJ Special Topics* 225:2141 (2016).
- 19.R. Jeanneret, D. O. Pushkin, V. Kantsler, and M. Polin(AC). "Particle entrainment dominates the interaction of microalgae with micron-sized objects." *Nat. Commun.* 7:12518 (2016).
- 20.M. Contino, E. Lushi, I. Tuval, V. Kantsler, and M. Polin(AC). "Microalgae scatter off solid surfaces by hydrodynamic and contact forces." *Phys. Rev. Lett.* 115:258102 (2015).
- 21.D.R. Brumley, M. Polin, T. J. Pedley, and R. E. Goldstein. "Metachronal waves in the flagellar beating of *Volvox* and their hydrodynamic origin." *J. Roy. Soc. Interface* 12:20141358 (2015).
- 22.D.R. Brumley, Y. K. Wan, M. Polin, and R. E. Goldstein. "Flagellar Synchronization Through Direct Hydrodynamic Interactions." *eLife* 3:e02750 (2014). **Selected for a "Insight" article in eLife.**
- 23.K. C. Leptos, Y. K. Wan, M. Polin, I. Tuval, A. Pesci, and R. E. Goldstein(AC). "Antiphase synchronisation in a flagellar-dominance mutant of *Chlamydomonas*." *Phys. Rev. Lett.* 111:158101 (2013).

Non Peer-Reviewed: R. Jeanneret and M. Polin, *Nature* 603, 795 (2022) (*News and Views*); M. Polin and I. Tuval, *APS Physics* 115, 258102 (2015).

C.2. Congresses. (Tot presentations: **21 invited** at conferences; **24 invited** at seminar series; **4 invited** at schools; 24 contributed at conferences).

Selected invited conf. presentations in the last 10 years:

- 06/2023 ASLO Aquatic Sciences Meeting 2023 (Palma de Mallorca, Spain)
- 11/2022 ISABMEC 2022 (Tottori University, Japan)
- 02/2022 Lorentz Centre Workshop "Self-organization under confinement" (U. Leiden).
- 10/2020 SPP Microswimmers 2020 (Forschungszentrum Jülich, Germany). (Online)
- 07/2019 Statistical Physics Meets Movement Ecology (University of Bristol, Bristol, UK).
- 01/2018 COST Active Matter Conference. (Nice, France).
- 01/2017 COST Flowing Matter Conference (Porto, Portugal).
- 06/2015 STATPHYS Satellite Meeting, (Station Biologique de Roscoff, Roscoff, France).
- 03/2015 DPG Spring Meeting. (Berlin, Germany).
- 11/2014 Jülich Soft Matter Days, (Jülich, Germany).
- 09/2014 European Fluid Mechanics Conference. (Copenhagen, Denmark).

Meetings Organised: 2019 Biologically Active Fluids Annual Meeting (UK, National); 2022 6th Microscale Ocean Biophysics (Esp, International); 2022 ETN PHYMOT 1st Annual



Meeting (Esp, International); 2022 Focus Session T05 (USA, International); 2022 European Physical Society CMD 29 Meeting, 2-days Minicolloquium (UK, International).

C.3. Research projects and grants (since 2013)

- Sept. 2023 Consolidación Investigadora (MICINN) (€199,602; PI)
- May 2022 **Horizon Europe MSCA CITIZENS Project** (€300,000; PI and **Coordinator**)
- Nov. 2021 **Human Frontiers Science Program Grant** (€1,235,000; Co-PI)
- Feb. 2021 **MSCA ETN PHYMOT** (€4,106,256; Co-PI)
- June 2020 **Spanish National Plan «Proyectos de I+D+i»** (€180k; Co-PI).
- Oct. 2018 **Leverhulme Research Grant** (£ 300,000; PI)
- Jan. 2017 IAS Developing Ideas Seed Award (£1.5k).
- Sept. 2016 Pump-priming from AMR INTEGRATE (EPSRC-funded) (£ 48k; Co-PI).
- Sept. 2016 **Leverhulme Research Grant** (£ 300,000; Co-PI)
- Jan. 2016 EPSRC AMR grant EP/M027503/1 (£500,000; Co-I).
- Sept. 2015 **Royal Society Research Grant** (£15000; PI).
- Apr. 2015 EPSRC Equipment Grant EP/M028186/1 (£515,000; Co-I)

C.4. Contracts, technological or transfer merits

- *Manipulation of objects in potential energy landscapes.*
U.S. Patent 20090101807, New York University (2009). Licensed by Arrayx Ltd.

Fellowships and Honours (since 2013):

- Oct. 2017 Albert Shimmins International Fellowship. (AU\$15355). U. Melbourne.
- Oct. 2017 Visiting Fellowship, School of Math. & Stat. (AU\$14688). U. Melbourne.
- Mar. 2016 Visiting Fellowship (€3000). University of the Balearic Islands.
- Oct. 2013 Visiting Fellowship (€1300). University of the Balearic Islands.
- 2010 - 2013 Junior Research Fellowship, Clare Hall, Cambridge. (*Now Life Member*)

Professional Service (since 2013):

Grant Reviewing: The Royal Society, BBSRC, EPSRC, ERC (StG, CoG), ASF, ISF, HFSP.

Journal Rev.: 68 reviews for 23 journals since 2018 (earlier records unavailable), including: Nature, Nature Phys.; Nat. Commun.; Comm. Physics; Sci. Rep.; eLife; PNAS; PNAS Nexus; PRL; PRX; Biophys. J.; J. Fluid Mech.; Phys. Rev. Fluids.; Soft Matter; Proc. Roy. Soc. A.

Committee Membership: **2022-present Coordinator** of Horizon Europe MSCA CITIZENS Proj. "Ocean Night"; **2021-present: Management Committee** of H2020 ETN PHYMOT; **2020-present: Member of the International Exchanges Committee** of the Royal Society (UK); 2017-2020: Member of the Management Committee and PhD Review Panel for MRC-funded IBR Doctoral Training Partnership