

# Curriculum Vitae Matteo Ceccarelli

**Citizen:** Italian

**Civil Status:** Married with 3 children

**Mother Tongue:** Italian

**Other Languages:** good English and French

**Total number of Articles:** 105 (Research Gate)

**Total citation:** 2642 (Research Gate)

**H factor:** 32 (Research Gate)

**i10 index:** 59 (SCOPUS)

**ORCID:** <https://orcid.org/0000-0003-4272-902X>

## Education

- 2013: Habilitation as Full Professor in Applied Physics
- 2010: Habilitation as Associate Professor in Applied Physics at the University of Milan
- 1997-May 2001: PhD at the École Normale Supérieure, Lyon, France: *Numerical simulations of the primary electron transfer in a photosynthetic reaction center*  
*Advisors:* Prof. S. Baroni, International School for Advanced Study SISSA/ISAS, Trieste IT and Dr. M. Marchi, Commissariat à l'Énergie Atomique CEA, Saclay FR.
- 1988-1994: Laurea in Physics, Università degli Studi di Cagliari, Italy: *Numerical methods for macromolecular systems*  
*Advisors:* Prof. F. Meloni, Università degli Studi di Cagliari (IT) and Prof. S. Baroni, SISSA/ISAS, Trieste (IT)

## Professional Experiences:

- 3/2018-12/2018: Consultant for VenatorX (US) on permeation of antibiotics in Gram- Bacteria
- 2010-2015: member of the scientific council at IOM/CNR
- Since 2011: Associate Professor in Biophysics at the Università degli Studi di Cagliari (IT)
- Since 2004: Assistant Professor in Biophysics at the Università degli Studi di Cagliari (IT)
- 7/01-12/03: Post-Doc at ETHZ Zurich, c/o CSCS and USI Lugano (CH) c/o Parrinello's Group
- 3/01-6/01: Post-Doc at MPI Stuttgart (DE) c/o Parrinello's Group
- 9/98-2/01: Marie Curie fellow at Cecam/Ens Lyon (FR)
- 9/97-8/98: Stage at Cecam/ENS Lyon (FR) within the INFM program Progetto Sud
- 10/96/8/97: Contract in a software company, Cagliari, Italy
- 10/95-9/96: Stage at CEA-Saclay on Biophysics (FR)
- 3/95-12/95: Stage at CNR/Università degli studi di Cagliari (IT)
- 1/94-10/94: Stage at SISSA/ISAS Trieste (IT)

## Research Interests:

- Transport phenomena: ion channels
- Transport phenomena: bacterial and eukaryotic porins
- Transport phenomena: electron transfer
- Predictions of small-molecules transport
- Receptors and TBDT (Siderophores)
- Peptides in solutions
- Correlations in proteins
- Molecular machines (catenanes)
- Kinetic analysis of current noise in electrophysiology
- Single-Molecule Single-Channel electrophysiology
- Diffusion of small ligand in protein complexes (Hemoglobin, myoglobin, enzymes)
- Numerical Algorithms for Molecular Dynamics Simulations and Rare events

## ***Resume***

He received in 2001 the PhD in Biophysics from ENS Lyon (CECAM laboratory, Marie Curie Fellow FP4) and then he performed research on computational methods tailored for biophysical systems at MPI-Stuttgart and ETH-Zurich, under the supervision of Prof. Parrinello.

Since 2004 he is appointed at the University of Cagliari, since 2011 as Associate Professor in Biophysics. He got the habilitation as Full Professor in Biophysics in 2013. In the period 2011-2015 he was an elected member of the scientific council of the CNR/IOM. Since 2015 he is coordinator of two bachelor programs at the Faculty of Medicine, Techniques of Medical Laboratories and Techniques of Radiology and Medical Imaging, both with a strong interest in the topic of the present project, and the Master in Health Professions of Technical Diagnostic Sciences.

He is an expert of transport phenomena at the molecular scale, passive diffusion through nanopores, porins and ion channels (from prokaryotic and eukaryotic cells) and active diffusion with receptors, characterization of peptides and other small-molecules in solution, ligand-protein interactions, and computational methods for enhanced sampling.

He has a long experience with the management of European projects and in 2007 he was appointed by its department to follow a period of coaching/training as Project Manager. During the PhD he got an individual Marie Curie project for which he was also directly responsible for the communications with EU and planning of the scientific work. More recently he was local coordinator of two ITN projects for the part dedicated to modelling and was coordinator of a Marie Curie project for a post-doc (AQPAssoc). During the recent IMI project "Translocation", he was one of the three promoters and appointed as academic leader of the WP2 dedicated to transport properties through porins, the most important topic with 7.5 Meuro budget (over 15 Meuro in total for 8 WPs) and 7 participating groups. He was also strongly involved in the WP3 dedicated to receptors and active transporters for pursuing the Trojan Horse approach.

He has acquired a very deep and extensive knowledge of passive diffusion of antibiotics through bacterial porins. He was consultant of a few pharmaceutical companies, and now he is external collaborator in 3 projects (one funded by IMI-ENABLE, one by JPIAMR, one proposal submitted to NHMRC, Australia) with the aim to explicitly enhance permeation for lead antibiotics in early drug discovery, an approach that never was used in the past.

## ***Teaching activity***

Since 2004 I have taught at the Faculty of Medicine. Since 2018/2019 I am teaching the Biophysics course, mainly directed to master students in Physics. I am constantly in contact with a biological-medical environment, also through the participation to Specialization classes of Medicine, Medical Physics, Anaesthesia and Reanimation, Orthopaedic. I am a member of the PhD school in Physical Sciences. In 2010 the Jacobs University of Bremen offered me to teach in the Master of Life Sciences with a course on Molecular Modelling. Since 2015 I am President of two Graduate Schools in the Faculty of Medicine, Technicians of Biomedical Laboratory and Radiology, Imaging and Radiotherapy, and the Master in Diagnostic Scientific Techniques. In 2017 I taught in the special PhD program on Nonlinear Phenomena (CANES) at King's College, London.

## ***Networking for teaching:***

- Erasmus agreement with Paris-Diderot since 2012.
- Since 2018 with Barcelona for PhD exchange
- Several participation to PhD examen at Jacobs University Bremen, one at Cardiff University

## ***Networking for research:***

- Since 2003: Mathias Winterhalter, Jacobs University, Bremen (DE)
- Since 2011: James H. Naismith, University of St.Andrews (UK) and now University of Oxford (UK)
- Since 2013: University of Newcastle (UK), CNRS Strasbourg (FR)
- Contacts with private companies since 2006: Nanion, Basilea Pharmaceutica, Johnson&Johnson, Astra Zeneca, Glaxo Smith Kline, VenatoRx, Elements.

## ***Transversal Skills***

I was trained with repeated sessions in quality and self-evaluation and from 2006 to 2014 I was responsible of quality for a medical professional diploma. I was also trained for a semester, approximately 180 hours of

classes, in Project Management, advanced level, organized by the Italian CRUI (Conferenza Rettori Università Italiane).

### **Relevant Scientific Techniques**

Since my PhD I have worked in contact with many important computer centers in Europe (Cea/Grenoble and Idris/Paris doing the PhD in France, CSCS/Manno as Post-doc in Switzerland, Cineca/Bologna, Caspur/Roma and Cybersar/Cagliari as researcher in Italy). I am also reviewer of grant for computational resources for HPC in Italy and Europe.

### **European/International Projects:**

- 1998-2001, 3 years grant: Marie Curie PhD Fellowship, Coordinator
- 2002-2003, Top-Nano21, Molecular Switches, Switzerland
- 2006-2009, FP6-RTN on antibiotics permeation, Local Coordinator
- 2008-2009, Johnson&Johnson antinfectives, antibiotics permeation, Coordinator
- 2010-2012, FP7-IIF, aquaporin channels, Coordinator
- 2013-2016, FP7-ITN on antibiotics permeation, Local Coordinator
- 2013-2018, IMI project, ND4BB: Academic Leader of WP2, antibiotics permeation
- 2019-2021: JPI-EC-AMR, Reset-Me, External Partner

### **National Projects:**

PRIN 2007 (Hemoglobins), 2013 (eukaryotic porins), 2015 (Intracellular channels)  
2008-2009, INFM/CNR, Seed projects for young researchers, Hemoglobins

### **Regional Projects:**

2006-2008, Progetto Cybersar  
2006-2008, MIUR, program in biomedical applications, Antiviral Compounds  
2010-2011, LR7, Inhibitors for Gram positive cocci  
2010, 2011, 2012, 2014, 2016: LR7  
2017-2019: Fondazione Banco di Sardegna, Physical Chemistry of Proteins in solutions  
2020-2022: Fondazione Banco di Sardegna, Analysis of bacterial envelopes, the S-layer

### **Articles 2015-2020:**

1. Milenkovic, S. *et al.* The mechanism and energetics of a ligand-controlled hydrophobic gate in a mammalian two pore channel. *PCCP* **22**, 15664 (2020). doi:10.1039/D0CP00805B
2. Bafna, J. A. *et al.* Kanamycin Uptake into Escherichia coli Is Facilitated by OmpF and OmpC Porin Channels Located in the Outer Membrane. *ACS Infect. Dis.* **6**, 1855–1865 (2020).
3. Farci, D. *et al.* Structural insights into the main S-layer unit of Deinococcus radiodurans reveal a massive protein complex with porin-like features. *Journal of Biological Chemistry* **295**, 4224–4236 (2020).
4. Vergalli, J. *et al.* Porins and small-molecule translocation across the outer membrane of Gram-negative bacteria. *Nat Rev Micro* **33**, 1831–13 (2019).
5. Benkerrou, D. *et al.* A perspective on the modulation of plant and animal two pore channels (TPCs) by the flavonoid naringenin. *Biophys. Chem.* **254**, 106246 (2019). doi:10.1016/j.bpc.2019.106246
6. Moynié, L. *et al.* The complex of ferric-enterobactin with its transporter from Pseudomonas aeruginosa suggests a two-site model. *Nature Communications* **10**, 3673–14 (2019).
7. Bodrenko, I. V., Salis, S., Acosta-Gutierrez, S. & Ceccarelli, M. Diffusion of large particles through small pores: From entropic to enthalpic transport. *J Chem Phys* **150**, 211102 (2019).
8. Coines, J., Acosta-Gutierrez, S., Bodrenko, I., Rovira, C. & Ceccarelli, M. Glucose transport via the pseudomonad porin OprB: implications for the design of Trojan Horse anti-infectives. *Phys Chem Chem Phys* **14**, 529–8463 (2019).
9. Scoriapino, M. A. *et al.* Complexes formed by the siderophore-based monosulfactam antibiotic BAL30072 and their interaction with the outer membrane receptor PiuA of P. aeruginosa. *Biometals* **32**, 155-170 (2019). doi:10.1007/s10534-018-00166-0
10. Moynié, L. *et al.* Preacinetobactin not acinetobactin is essential for iron uptake by the BauA transporter of the pathogen Acinetobacter baumannii. *Elife* **7**, 802 (2018).
11. Acosta-Gutierrez, S. *et al.* Getting Drugs into Gram-Negative Bacteria: Rational Rules for Permeation through General Porins. *ACS Infect. Dis.* **4**, 1487–1498 (2018).
12. Samanta, S. *et al.* Getting Drugs through Small Pores: Exploiting the Porins Pathway in Pseudomonas aeruginosa. *ACS Infect. Dis.* **4**, 1519–1528 (2018).

13. Pathania, M. et al. Unusual Constriction Zones in the Major Porins OmpU and OmpT from *Vibrio cholerae*. *Structure* (2018). doi:10.1016/j.str.2018.03.010
14. Guardiani, C. et al. yVDAC2, the second mitochondrial porin isoform of *Saccharomyces cerevisiae*. *Biochim Biophys Acta* 1859, 270–279 (2018).
15. Benkerrou, D. & Ceccarelli, M. Free energy calculations and molecular properties of substrate translocation through OccAB porins. *Phys Chem Chem Phys* 20, 8533–8546 (2018).
16. Manzo, *et al.* Folded Structure and Membrane Affinity of the N-Terminal Domain of the Three Human Isoforms of the Mitochondrial Voltage- Dependent Anion-Selective Channel. *ACS Omega* 3, 11415–11425 (2018).
17. Serra, I. *et al.* Effects of amphipathic profile regularization on structural order and interaction with membrane models of two highly cationic branched peptides with  $\beta$ -sheet propensity. *Peptides* 105, 28–36 (2018).
18. Bodrenko, I. V., Wang, J., Salis, S., Winterhalter, M. & Ceccarelli, M. Sensing Single Molecule Penetration into Nanopores: Pushing the Time Resolution to the Diffusion Limit. *ACS Sens* 2, 1184–1190 (2017).
19. Bajaj, H. et al. Bacterial Outer Membrane Porins as Electrostatic Nanosieves: Exploring Transport Rules of Small Polar Molecules. *ACS Nano* 11, 5465–5473 (2017).
20. Ghai, I. et al. General Method to Determine the Flux of Charged Molecules through Nanopores Applied to  $\beta$ -Lactamase Inhibitors and OmpF. *J Phys Chem Lett* 8, 1295–1301 (2017).
21. Scorciapino, M. A. et al. Rationalizing the permeation of polar antibiotics into Gram-negative bacteria. *J Phys Condens Matter* 29, 113001 (2017).
22. Manzo, G. *et al.* The singular behavior of a  $\beta$ -type semi-synthetic two branched polypeptide: three-dimensional structure and mode of action. *Phys Chem Chem Phys* 18, 30998–31011 (2016).
23. Ferrara, L. G. M. et al. MOMP from *Campylobacter jejuni* Is a Trimer of 18-Stranded  $\beta$ -Barrel Monomers with a Ca(2+) Ion Bound at the Constriction Zone. *J Mol Biol* 428, 4528–4543 (2016).
24. Guardiani, C., Leggio, L., Scorciapino, M. A., De Pinto, V. & Ceccarelli, M. A computational study of ion current modulation in hVDAC3 induced by disulfide bonds. *Biochim Biophys Acta* 1858, 813–823 (2016).
25. Acosta-Gutierrez, S., Bodrenko, I., Scorciapino, M. A. & Ceccarelli, M. Macroscopic electric field inside water-filled biological nanopores. *Phys Chem Chem Phys* 18, 8855–8864 (2016).
26. Bajaj, H. et al. Molecular Basis of Filtering Carbapenems by Porins from  $\beta$ -Lactam-resistant Clinical Strains of *Escherichia coli*. *J Biol Chem* 291, jbc.M115.690156–2847 (2016).
27. Reina, S. et al. VDAC3 as a sensor of oxidative state of the intermembrane space of mitochondria: the putative role of cysteine residue modifications. *Oncotarget* 7, 2249–2268 (2016).
28. Guardiani, C. et al. The N-Terminal Peptides of the Three Human Isoforms of the Mitochondrial Voltage-Dependent Anion Channel Have Different Helical Propensities. *Biochemistry* 54, 5646–5656 (2015).
29. Zahn, M. et al. Small-Molecule Transport by CarO, an Abundant Eight-Stranded  $\beta$ -Barrel Outer Membrane Protein from *Acinetobacter baumannii*. *J Mol Biol* 427, 2329–2339 (2015).
30. Acosta-Gutierrez, S., Scorciapino, M. A., Bodrenko, I. & Ceccarelli, M. Filtering with Electric Field: The Case of *E. coli* Porins. *J Phys Chem Lett* 6, 1807–1812 (2015).
31. Bodrenko, I., Bajaj, H., Ruggerone, P., Winterhalter, M. & Ceccarelli, M. Analysis of fast channel blockage: revealing substrate binding in the microsecond range. *Analyst* 140, 4820–4827 (2015).

### **Recent Oral contributions:**

- CCP 2017, Parigi (FR), *Contributed*
- Conference: *Molecular basis of antibiotic permeability in Gram-negative bacteria*, 2017 Braunschweig (DE), *Invited*
- Conference on Nanopores, Bremen (2017) *Invited*
- ACS SPRING 2017, San Francisco (US), *Contributed*
- ACS FALL 2018, Boston, *Contributed*
- SIF: 2011, 2012, 2016, 2017
- School on Biophysics, SIBPA, Venezia 1-2018, *Invited Speaker*
- Workshop: *Getting small drug-like molecules into Gram-negative bacteria*, 2018 Oxford (UK)
- Workshop: *Nanofluidics in Physics and Biology*, 2018 Lyon (FR)
- National Conference SIBPA, Ancona 9-2018, *Invited*
- ECCMID 2019, Amsterdam, *Contributed*
- ACS FALL 2019, San Diego (US), *Contributed*
- CECAM workshop: *Network analysis to elucidate natural system dynamics, diversity and performance*, Lyon 2019, *Contributed*
- CECAM Conference 50 years, Lausanne, *Contributed*
- SIF-2019, L'Aquila, *Invited*
- Processes in Isotopes and Molecules 2019, Cluj-Napoca (RO), *Invited*

- *SIF-2020*, online, *Invited*
- *Frontiers in ion channels and nanopores: theory, experiments and simulations*, online, 2021, *Invited*

***Visits for teaching:***

- DAAD/Jacobs University Bremen 3-4/2010, Bremen (DE)
- King's College 3/2017, London (UK)

***National/International Prizes/Awards:***

- In 1998 PhD Marie Curie Fellow at ENS-Lyon (FR)
- In 2008 CNR Seed grant for young researchers
- 2012: Second best presentation in Physics, National Meeting SIF, L'Aquila (IT)
- 2019: Best poster presentation, Novel Antimicrobial and AMR Diagnostic 2019, Berlin

***Organization of International Conferences as main organizer:***

- Workshop for Laurea ad Honorem to Prof Michele Parrinello, Cagliari June 2006. Title: *Simulations and rare events*
- International Workshop, Cagliari 6-8 May 2009.  
Title: *From Structure to Function: Influx and Efflux Systems*  
International Funding: CECAM, ESF, EU-RTN FP6
- International Workshop, Cagliari 19-20 May 2015  
Title: *Drug Discovery*  
International Funding: EU FP7
- Final Meeting project Translocation 2013-2017, Braunschweig, June 16<sup>th</sup> 2017
- CECAM Workshop "Nanopore Translocation and Nanochannel Confined Biopolymers", postponed for COVID-19

***Reviewer:***

- ACS journals, RSC journals, BBA journals, Plos journals, Nature group journals
- Projects for Computational Resources (PRACE), PRIN, Rita-Levi Montalcini, DAAD, EU-COST