
BIOGRAPHICAL SKETCH

NAME: Francesca Valetti

POSITION TITLE: Associate Professor of Biochemistry at University of Torino (Italy)

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Completion Date MM/YYYY	FIELD OF STUDY
University of Torino (Italy)	MSc	11/1992	Biology
University of Torino (Italy)	PhD	07/1997	Protein Chemistry
Imperial College London (UK)	Postdoctoral	12/1998	Redox Protein Engineering

Personal Statement

Associate Professor of Biochemistry, my research is focused on studying and enhancing the performances of enzyme catalysts for energy production, green processes and bioremediation. The applied strategies are enzymology, protein engineering, protein design and modelling by site directed mutagenesis and by novel directed evolution techniques (iterative site saturation mutagenesis). A particular emphasis is given to the study of [FeFe]-hydrogenases for molecular hydrogen production, for artificial devices and solar driven bioelectrodes. Another applicative perspective is focused to the bio-production of specific chemicals and building blocks by enzyme-driven reactions, in order to propose innovative and sustainable bio-based industrial processes.

Track-record

Author of 34 publications, 4 reviews, 3 conference papers and 2 editorials in international journals ISI 1 patent. H-index:20, i10-index:27, 911 citations (source: Scopus 13th April 2025). Participating in 14 international and 13 national congresses. Invited speaker at 7 congresses and 2 residential PhD Schools. Complete list of published work at: [Scopus Author ID: 6603287801](#)

Ongoing and recently completed projects (participation and direction -last 5 years-):

- 2023-ongoing National Coordinator of PRIN project MORF "Molecular determinants of Oxygen Resistance in a unique [FeFe]-hydrogenase" (€ 111403)
- 2023-ongoing Local coordinator for UNITO unit of PRIN PNRR project SMARFeS "Small Molecule Activation by Redesigned iron-sulfur (FeS) proteins" (€ 60000)
- 2022- ongoing Local co-coordinator for UNITO project PERCIVAL (€ 279653) PON Ricerca Industriale e Sviluppo Sperimentale nelle 12 aree di specializzazione individuate dal PNR 2015 – 2020, di cui al Decreto Direttoriale del 13 luglio 2017, n. 1735. (Chimica Verde, CIPE)
- 2022- PI for Ex-Post 2020 funding scheme di Fondazione San Paolo (€ 59358) "Generation of Renewable Fuel with Enzyme based Photo Electrochemical Cells-GOPHORCELL"
- 2019-2022 PI for DBIOS, Università di Torino (€ 158760) project SATURNO "Scarti organici e Anidride carbonica Trasformati in carbURanti, fertilizzanti e prodotti chimici; applicazione concreta dell'ecoNOmia circolare" finanziato da POR FESR 2014-2020 EU Structural Funds, competitive call su Piattaforma Bioeconomia Regione Piemonte
- 2019-2021 PI Ex-Post funding scheme di Fondazione San Paolo (€ 51380) "A sustainable hybrid platform for enzyme-based biofuel production synergically managing waste"

Positions, Scientific Appointments, and Honors

2023-present: Faculty of PhD program of Innovation for the Circular Economy

2022-present: Associate Professor in Biochemistry at University of Torino.

2018-present: Associate Editor for Biotechnology and Applied Biochemistry (Ed. Wiley)

2015-present: Member of The Protein Society
2013-present: Member of the American Chemical Society – ACS
2004–2021: Senior Lecturer in Biochemistry at University of Torino
2001-present: Member of S.B.I.C. Society of Biological Inorganic Chemistry
1999-2004: Permanent staff as research assistant at University of Torino.
1997-1999: Post-doctoral research associate at Biochemistry Department Imperial College London (UK) with an EC sponsored fellowship within the Biotech program
1993-present: Member of the Italian Biochemical Society SIB

Other institutional roles (present)

Delegate for Università di Torino in Hydrogen Europe Research, on Roadmap RM-2. Member of EERA European platform and of work group for Bioenergy, Vice-director and member of executive committee of NIS Center for Nanomaterials for Industry and Sustainability, Member of the Public Engagement Committee of the University of Torino, Vice- President of the Master Degree in “Industrial Biotechnology”.

Contributions to Science

A main line is directed toward the study of hydrogen-producing enzymes, both for applications in the field of bioenergy and to investigate the details of the fine catalytic mechanism. The research has been carried out since 2008, with the participation, in collaboration with Imperial College London (Prof. J. Barber /Prof. Gilardi) in a European project (SOLHYDROMICS project EC program FP7-Energy, Collaborative project 227192-2, coordinated by the Politecnico di Torino) dedicated to the study of the nano-leaf, for coupling photoactivated systems to hydrogen-producing enzymes. Subsequent developments involved biotechnological aspects, such as interfacing [FeFe]hydrogenases to electrodes and semiconductor materials (photoactivatable metal oxides), and the optimization of conditions for hydrogen production from waste biomass, as well as aspects of fundamental biochemistry (details of the proton transport pathway by site-saturation mutagenesis and characterization of a new enzyme in the class with a unique mechanism of protection against damage by oxygen). Equipment and methods have been set up and fine-tuned to express in recombinant form in *E. coli* and work under anaerobic conditions on [FeFe]-sensitive oxygen hydrogenases from *Clostridium acetobutylicum* and from *Chlamydomonas reinhardtii*, to measure their catalytic activity in both consumption and hydrogen production (with a dedicated GC line) and to characterize their redox states by FTIR. The research resulted so far in 15 publications (11 as corresponding author). 2 regional projects (BIOH₂ and HyStrEM), 2 feasibility studies (BIOTHYTAN and COMPIDRO) on EU POR-FESR funds have been funded on this topic and 1 project (MORF) is ongoing funded by PRIN 2022 National Italian funding (coll. University of Milano Bicocca). Additional supporting funds were obtained from Compagnia di San Paolo, Torino, Fondazione CRT Lagrange project, DAAD, Erasmus Traineeship. Currently, research is expanding to H₂-related enzymes involved in the reductive conversion of CO₂ to formate, with an additional POR-FESR-funded project 2019-2023 (SATURNO) and to engineering of mini redox proteins performing small molecule activation (H₂, CO₂) with a PRIN PNRR 2022 National Italian funding project (SMARFeS) coordinated by University of Milano Bicocca and in collaboration with University of Naples “Federico II”.

A second line of research is focused on the study of catechol dioxygenase and related metabolic pathway for applications in biocatalysis and bioremediation. This led to the recombinant production of a bacterial catechol 1,2-dioxygenase from *A. radioresistens* S13, not requiring reduction equivalents for molecular oxygen activation and subsequent dearomatization of catechol and its derivatives. Both site-specific mutagenesis results with details of the fine structure-function relationship and its modulation by amino acids have been published, as well as application-related results related to the stabilization of the enzyme for biocatalysis (conversion of catechol to muconic acid for sustainable production of adipic acid). The topic has led to the publication of 10 papers. An Italian patent has been filed for the encapsulation and stabilization of the enzyme catechol 1,2-dioxygenase WT and its mutants in silica/hormosil gels and their use for bioremediation of materials contaminated with catechols and their derivatives.

Academic collaboration: Dr. P.W. King, NREL, Golden, CO, USA (co-author of 3 papers), Prof. Elio Giamello e Prof. Mario Chiesa, Dipartimento di Chimica, Università di Torino, Italy (co authors of 2 papers),

Prof. Thomas Happe, RUHR-UNIVERSITÄT BOCHUM, Germany (co-author of 1 paper in Nature Comm), Prof. Christophe Leger, CNRS, Marseille, France co-author of 1 paper in Nature Comm), Prof. Vincent Artero, CEA, Grenoble, France, Prof. Gustav Berggren, Dept. of Chemistry – Ångström Laboratory Uppsala University, Uppsala, Sweden, Prof. Golbeck of Penn State University, USA, Prof. Maria Lodovica Gullino, DISAFA e Agroinnova, Università di Torino (co-author of 2 papers), Prof. Stefano Bruno, Prof. Andrea Mozzarelli, University of Parma, Prof. Menico Rizzi, University of Piemonte Orientale, Prof. Loredano Pollegioni, Univ. Insubria), Prof. Simone Morra (University of Nottingham, UK), Prof. Claudio Greco, Prof. Luca Bertini, Prof. Federica Arrigoni, University of Milano Bicocca, Prof. Marco Chino, University of Naples “Federico II”.

Industrial collaboration: Dr. Toby Meyer, Solaronix, Aubonne, Switzerland (co-author of 1 paper), Dr. Ing. Paola Zitella, Environment Park, Torino, Italy (co-author of 2 papers), Prof. Massimo Pugliese, AgriNewTech, Grugliasco, Italy (co-author of 2 papers).

Relevant papers (last 10 years)

- 1) Mazzoli, R., Pescarolo, S., Gilli, G., Gilardi, G., **Valetti, F***. (2024), Hydrogen production pathways in Clostridia and their improvement by metabolic engineering *Biotechnology Advances*, 73, 108379, 2
- 2) Gasteazoro, F., Catucci, G., Barbieri, L., Gilardi, G., **Valetti, F***. (2024), Cascade reactions with two non-physiological partners for NAD(P)H regeneration via renewable hydrogen *Biotechnology Journal*, 19(4), 2300567, 1
- 3) **Valetti, F***, Morra, S., Barbieri, L., Sadeghi, S.J., Gilardi, G. (2024) Oxygen-resistant [FeFe]hydrogenases: new biocatalysis tools for clean energy and cascade reactions, *Faraday Discussions*, 252, pp. 223–240,
- 4) Elisa Vignali, Loredano Pollegioni, Giovanna Di Nardo, **Francesca Valetti**, Silvia Gazzola, Gianfranco Gilardi, Elena Rosini. (2021) Multi-Enzymatic Cascade Reactions for the Synthesis of cis,cis-Muconic Acid *Advanced Synthesis & Catalysis*
- 5) Arizzi M, Morra S, Gilardi G, Pugliese M, Gullino ML, **Valetti F***. (2021) Improving sustainable hydrogen production from green waste: [FeFe]-hydrogenases quantitative gene expression RT-qPCR analysis in presence of autochthonous consortia *BIOTECHNOLOGY FOR BIOFUELS* Volume: 14 Issue 1 Article number 182
- 6) Winkler M, Duan J, Rutz A., Felbek C, Scholtyssek L, Lampret O, Jaenecke J, Apfel, Gilardi G, **Valetti F**, Fourmond V, Hofmann E, Léger C, Happe T. (2021) A safety cap protects hydrogenase from oxygen attack *Nature Communications Open Access* Volume 12, Issue 1 December Article number 756
- 7) Morra, Simone; Arizzi, Mariaconcetta; **Valetti, Francesca***; Gilardi Gianfranco* (2016) Oxygen Stability in the New [FeFe]-Hydrogenase from *Clostridium beijerinckii* SM10 (CbA5H). *BIOCHEMISTRY* Volume: 55 Issue: 42 Pages: 5897-5900
- 8) Arizzi M, Morra S, Pugliese M, Gullino ML, Gilardi G, **Valetti F***. (2016) Biohydrogen and biomethane production sustained by untreated matrices and alternative application of compost waste *WASTE MANAGEMENT* Volume: 56 Pages: 151-157
- 9) Morra S, Maurelli S, Chiesa M, Mulder DW, Ratzloff MW, Giamello E, King PW, Gilardi G, **Valetti F***. (2015) The effect of a C298D mutation in CaHydA [FeFe]-hydrogenase: Insights into the protein-metal cluster interaction by EPR and FTIR spectroscopic investigation. *Biochim Biophys Acta*. (2015) Oct 16. pii: S0005-2728(15)00212-1. doi: 10.1016/j.bbabo.2015.10.005.
- 10) Micaella C, Bruno, S, Mozzarelli A, Caglio R, **Valetti F**, Pessione E, Giunta C. (2014) Ormosil gels doped with engineered catechol 1,2 dioxygenases for chlorocatechols bioremediation. *Biotechnol. Appl. Biochem.* 61, 297-303.