CV date	07 December 2021

Part A. PERSONAL INFORMATION

First name	Francisco Javier		
Family name	Ruiz Dueñas		
Gender (*)	male	Birth date	03/05/1969
ID number (DNI)	52089176H		
e-mail	fjruiz@cib.csic.es	URL www.cib.csic.es/research/microbial-plant-biotechnology	
Open Researcher & Contributor ID (ORCID) (*)	0000-0002-9837-5665		

(*) Mandatory

A.1. Current position

Position	Científico Titular		
Initial date	01 March 2017		
Institution	Centro de Investigaciones Biológicas Margarita Salas (CIB), CSIC		
Department/Center	Microbial and Plant Biotechnology Department		
Country	Spain	Teleph. number	+34 918373112
Key words	White biotechnology, Lignocellulose biorefinery, Lignin biodegradation, Fungi, Genomes, Secretomes, Microbial enzymes, Oxidoreductases, Heme-peroxidases, Structure-function relationships, Rational design, Protein engineering, Heterologous expression, Phylogenomics, Paleogenetics, Enzyme resurrection		

A.2. Previous positions (research activity interuptions, art. 14.2.b)

Period	Position/Institution/Country/Interruption cause
2016-2017	Investigador Distinguido/ CIB, CSIC/ Spain
2010-2016	Investigador Ramón y Cajal / CIB, CSIC/ Spain
2006-2009	Investigador Postdoctoral/ CIB, CSIC/ Spain
2003-2006	Investigador I3P/ CIB, CSIC/ Spain
2000-2003	Investigador Postdoctoral/ CIB, CSIC/ Spain
1999-2000	Investigador Postdoctoral/ CERM/ Italy

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Licenciado in Biology	Univ Complutense de Madrid (UCM)	1992
Certificate of Pedagogical Aptitude (CAP)	Univ Complutense de Madrid (UCM)	1993
PhD, Biology (Extraordinary doctorate award)	Univ Complutense de Madrid (UCM)	1999

Part B. CV SUMMARY *(max. 5000 characters, including spaces)*

His career has been focused on the study of lignocellulose-degrading fungi and their lignocellulolytic system from the organismal to the molecular level. He has contributed with significant advances to the knowledge of the composition and evolution of the enzymatic machinery responsible from lignocellulose transformation, and to understanding the lignin degradation by fungi, a key step in carbon recycling in land ecosystems and a central issue for the industrial use of plant biomass. From an applied point of view, these studies have been aimed to obtain and design biocatalysts based on ligninolytic oxidoreductases for their utilization in oxidative reactions of industrial interest.

These studies were initiated with the discovery and characterization of a new ligninolytic peroxidase family (versatile peroxidase, VP) (articles in Mol Microbiol, JBC, AEM) during his doctoral thesis at the Biotechnology for Lignocellulosic Biomass group (CIB) (1994-99). After a postdoctoral stay at the Magnetic Resonance Center (CERM, Florence) (1999-2000) leading a successful project on structure-function studies of proteins involved in copper trafficking in *Bacillus subtilis* (Biochemistry, J Mol Biol), he returned to the CIB to address VP structure-function studies (J Mol Biol, JBC) that made this enzyme a model ligninolytic peroxidase in the field of lignin degradation (J Exp Bot). Simultaneously, structure-function

studies of other oxidoreductases involved in lignin degradation were performed within several EU projects (FP3-FP6). In this period, he boosted one of the main lines of research in the Biotechnology for Lignocellulosic Biomass group today, focused on heme-peroxidases. The knowledge gained from these studies (participating as a R&C researcher, 2010-16) was crucial in genomic projects of lignocellulose-degrading fungi in collaboration with the US Dept of Energy Joint Genome Institute (DOE-JGI). In these studies: i) the origin of the enzymatic system responsible for lignin degradation was dated at the late Carboniferous, and its contribution to the end of coal accumulation on Earth was proposed (published in Science); ii) the enzymatic mechanisms of lignocellulose degradation were characterized (PNAS, PLoS Genetics, Biotechnol Biofuels); and iii) a wide inventory of oxidoreductases of biotechnological interest was generated (*Biofuels Bioprod Biorefin*).
Then, a great variety of ligninolytic peroxidases identified in fungal genomes was characterized (Biotechnol Biofuels), and the stability and catalytic properties of the most interesting enzymes of biotechnological interest were improved by protein engineering techniques (Biotechnol Biofuels, PLosOne, two Patents). These studies were carried out within 3 national (Hipop, Noesis, Genobioref) and 3 EU (PeroxiCats, Indox, EnzOx2; FP7 and H2020) projects mentioned below, in which Dr. Ruiz Dueñas was PI.
In the last few years he has coordinated (first as a Distinguished Scientist and then as a Tenured Scientist) a multiomic DOE-JGI project, with participation of 12 international research groups, focused on the evolution of the lignocellulolytic system using novel approaches. The composition of ancestral enzymatic machineries has been reconstructed through phylogenomic and paleogenetic studies, the evolutionary history of ligninolytic peroxidases has been determined, and enzymes that existed million years ago have been resurrected and functionally characterized (PNAS, Biotechnol Biofuels). These studies have had a significant impact in the field since they have revealed that: i) the evolution of a few enzymes, mainly oxidoreductases, correlates with the ability of saprotrophic fungi to colonize different lignocellulosic materials (Mol Biol Evol); and ii) the evolution of the enzymes involved in lignin degradation paralleled the evolution of lignin in plants (PNAS). These studies have also provided a new source of biocatalysts based on ancestral enzymes.
Dr Ruiz Dueñas participates in teaching activities, including PhD and Master Courses, and has supervised 4 doctoral theses (3 of them since 2014) awarded with *cum laude* distinction (1 more in progress), and 8 TFMs and 1 TFG (since 2014). He is a member of different scientific societies and belongs to the board of directors of the specialized group of Industrial Microbiology and Microbial Biotechnology of the SEM. He was a member of the organizing committee of the 4th International Conference on Biotechnology for Lignocellulose, 2016; and is a member of the scientific committee of the VIII National Congress of Industrial Microbiology and Microbial Biotechnology, 2022. He has participated in the Evaluating Committee for the research projects R&C in the area of Biosciences and Biotechnology BIO-RYC-2018; and in the selection board for specialized technicians of public research bodies (Area: Biorefineries of lignocellulosic biomass, OEP-2017, MICIU). He is also a member of the Thematic Network "Biotechnology of Lignocellulosic Materials".

Part C. RELEVANT MERITS *(sorted by typology)*
JCR articles, h Index,...

- Total citations: **6815** (WOS) and **10140** (Google Scholar)
- Average number of citations (last 5 years): **599**/year (WOS); **881**/year (Google Scholar)
- h index: **40** (WOS) and **43** (Google Scholar)
- Sexenios (six-year research periods): **4** (the last one obtained in 2019)

C.1. Publications

Author of **92 publications**, including **86 articles** and **reviews** in SCI journals, **4 book chapters** and **2 patents**. Of these, 56 have been published in journals ranked in the first quartile (Q1) and 22 in the first decile (D1) of their subject category in the year of publication.

2 Acta Crystallograph.D. (IF 2.68, Q1)
3 ACS Catal. (IF 9.30, Q1, D1)
1 Antioxidants (IF 6.31, Q1, D1)
2 Appl.Environ. Microbiol. (IF 3.54, Q1)
1 Biochemistry (IF 4.11, Q1)
2 Biochem.J. (IF 4.77, Q1)
1 Biofuels Bioprod.Biorefin. (IF 4.21, Q1)
1 Bioresource Technol. (IF 4.36, Q1, D1)
1 Biotechnol. Adv (IF 10.59, Q1, D1)
7 Biotechnol. Biofuels (IF 6.44, Q1, D1)

1 BMC Genomics (IF 3.98, Q1)
1 Catal. Sci. Technol. (IF 5.28, Q1, D1)
1 Chem. Eur. J. (IF 4.85, Q1)
1 Curr.Opin.Biotechnol. (IF 7.82, Q1, D1)
1 FEBS Letters (IF 3.58, Q1)
1 Front. Plant Sci. (IF 5.75, Q1, D1)
1 Int. J. Mol. Sci. (5.92, Q1)
7 J.Biol. Chem. (IF 4.25, Q1)
1 J.Biol. Inorg.Chem. (IF 3.90, Q1)
1 J. Electroanal.Chem. (IF 2.22, Q1)
1 J.Exp. Bot. (IF 4.27, Q1, D1)
4 J. Fungi (IF 5.81, Q1)
2 J.Mol. Biol. (IF 5.22,Q1)
1 Mol. Biol. Evol. (IF 16.24, Q1, D1)
1 Mol. Microbiol. (IF 6.36, Q1, D1)
1 Phys.Chem. Chem. Phys. (IF 3.57, Q1)
1 PLoS Genetics (IF 7.52, Q1, D1)
2 PLoS One (IF 3.05, Q1)
4 Proc.Natl.Acad.Sci.USA(IF 9.74, Q1,D1)
1 Science (IF 31.03, Q1, D1)
1 Sci. Rep. (IF 3.99, Q1)

- **From 2012**, a total of **50 articles** have been published. The following were **selected** among the most recent ones (**2016-2021**):

1. Sánchez-Ruiz MI, Ayuso-Fernández I... **Ruiz-Dueñas FJ** (10 authors) **2021**. Agaricales mushroom lignin peroxidase: from structure–function to degradative capabilities ***Antioxidants*** 10(9):1446 (**IF 6.31, Q1**, **D1**) (corresponding author)
2. Peña A, Babiker R, Chaduli D..., **Ruiz-Dueñas FJ** (18 authors) **2021**. A multiomic approach to understand how *Pleurotus eryngii* transforms non-woody lignocellulosic material **J. Fungi** 7(6):426 (**IF 5.81, Q1**) (corresponding author)
3. **Ruiz-Dueñas FJ**, Barrasa JM, Sánchez-García M (36 authors) **2021**. Genomic analysis enlightens Agaricales lifestyle evolution and increasing peroxidase diversity ***Mol. Biol. Evol.*** 38(4):1428-1446 (**IF 16.24, Q1**, **D1**) (corresponding author)
4. Aza P, Molpeceres G, **Ruiz-Dueñas FJ** and Camarero S. **2021**. Heterologous expression, engineering and characterization of a novel laccase of *Agrocybe pediades* with promising properties as biocatalyst **J. Fungi** 7(5):359 (**IF 5.81, Q1**)
5. Ayuso-Fernández I, De Lacey AL, Cañada FJ, **Ruiz-Dueñas FJ** and Martínez AT. **2019**. Redox potential increased during the evolution of enzymes degrading recalcitrant lignin. ***Chem. Eur J.*** 25, 2708-2712 (**IF 4.85, Q1**)
6. Ayuso-Fernández I, Rencoret J, Gutiérrez A, **Ruiz-Dueñas FJ** and Martínez AT. **2019**. Peroxidase evolution in white-rot fungi follows wood lignin evolution in plants. ***Proc. Natl. Acad. Sci. USA*** 116: 17900 - 17905 (**IF 9.4, Q1**)
7. Miyauchi S,… **Ruiz-Dueñas FJ**,… (23 authors) **2018.** Integrative visual omics of the white-rot fungus *Polyporus brumalis* exposes the biotechnological potential of its oxidative enzymes for delignifying raw plant biomass. ***Biotechnol. Biofuels*** 11:201 (**IF 5.45, Q1**)
8. Ayuso-Fernández I, **Ruiz-Dueñas FJ** and Martínez AT. **2018**. Evolutionary convergence in lignin-degrading enzymes. ***Proc. Natl. Acad. Sci. USA*** 115: 6428-6433 (**IF 9.58, Q1,D1**) (corresponding author)
9. Ayuso-Fernández I, Martínez AT and **Ruiz-Dueñas FJ**. **2017**. Experimental recreation of the evolution of lignin degrading enzymes from the Jurassic to date. ***Biotechnol. Biofuels*** 10:67 (**IF 5.49, Q1**, **D1**) (corresponding author)
10. Sáez-Jiménez V, Acebes S, Garcia-Ruiz E, Romero A, Guallar V, Alcalde M, Medrano FJ, Martínez AT and **Ruiz-Dueñas FJ. 2016.** Unveiling the basis of alkaline stability of an evolved versatile peroxidase. ***Biochem. J.*** 473, 1917-1928 (corresponding author)

C.2. Congresses

160 communications in international (117) and national (43) congresses.

C.3. Research projects

Coordinator of a **U.S. Department of Energy project** and a project of the **MICINN-AEI** in **Strategic Lines**; **PI** of 3 **EU** (**FP7** and **H2020**) projects, 3 projects of the **National Programme** for Research Aimed at the Challenges of Society and one **PROFIT** project; and participant in other 7 EU, 6 national and 2 regional projects. Eight of them are detailed below:

1. PLEC2021-007690; "Enzymatic synthesis and recycling of biobased furanic polymers" (**FURENPOL**); Funded by: MICINN-AEI Convocatoria de Proyectos de I+D+i en líneas

estratégicas; AT Martínez (coordinator); FJ Ruiz Dueñas (co-coordinator) (7 partners, including 3 companies); **2021-24**; Funding: **1 090 605** €, CIB **310 406** €.

2. BIO2017-86559-R; "Basidiomycete genomes for lignocellulose biorefineries" (**GENOBIOREF**); Funded by: MINECO–Programa Estatal de I+D+i Orientada a los Retos de la Sociedad; PIs: FJ Ruiz Dueñas and S Camarero, CIB; **2018-22**; Funding: **302 500** €.
3. H2020-BBI-PPP-2015-2-1-720297; "New enzymatic oxidation/oxyfunctionalization technologies for added value bio-based products" (**EnzOx2,** www.enzox2.eu); Funded by: EU, H2020 BBI-PPP; AT Martínez (coordinator); PI-CIB: FJ Ruiz Dueñas (12 partners, including 6 companies); **2016-19**; Funding: **3 000 000** €, CIB **606 000** €.
4. CSP15-1609; "Study of the lignocellulolytic machinery in saprobic wood and leaf litter degrading Agaricales"; Funded by: U.S. Department of Energy Joint Genome Institute (DOE JGI), CSP15 call; Coordinators FJ Ruiz Dueñas (CIB) and JM Barrasa (UAH) (12 partners, including European and U.S. Research institutes and Universities); **2015-22**.
5. BIO2014-56388-R; "New oxidative enzymes for sustainable industries" (**NOESIS**); Funded by: MINECO–Programa Estatal de I+D+i Orientada a los Retos de la Sociedad; PIs: S Camarero and FJ Ruiz Dueñas, CIB; **2015-18**; Funding: **250 000** €.
6. KBBE-2013-7-613549; "Optimized oxidoreductases for medium and large scale industrial biotransformations" (**INDOX**, www.indoxproject.eu); Funded by: EU, **FP7**; AT Martínez (coordinator); PI-CIB: FJ Ruiz Dueñas (15 partners, including 8 companies); **2013-16**; Funding: total **7 825 824** €, CIB **892 540** €.
7. BIO2011-26694; "Screening and Engineering of New High Redox-Potential Fungal Peroxidases" (**HIPOP**); Funded by: MICINN-Programa de Investigación Fundamental; PI: FJ Ruiz Dueñas, CIB; **2012-15**; Funding: **279 510** €.
8. KBBE-2010-4-265397; "Novel and more robust fungal peroxidases as industrial biocatalysts" (**PEROXICATS**, www.peroxicats.org); Funded by: EU, **FP7**; PI-CIB: FJ Ruiz Dueñas (4 partners, including 2 companies); **2010-13**; Funding: total **2 999 350** €, CIB **732 114** €.

C.4. Contracts, technological or transfer merits

Contracts

- "Production of industrial enzymes using plants as biofactories" AGRENVEC S.L. June 2003-December 2005. PI-CIB (CSIC)*:* FJ Ruiz Dueñas. 56 000 €.
- "Optimization of the heterologous expression of peroxidases and oxidases, and production of enzymes modified by site-directed mutagenesis" CSIC. May 2000-December 2002. PI: AT Martínez, CIB.
- "Folding structure and activity of engineered metalloproteins at high resolution". Consorzio Interuniversitario Risonanze Magnetiche di Metalloproteine Paramagnetiche (CIRMNP), Florence, Italy. April 2000-May 2000. PI: Lucia Banci, CERM.
- "Foundations for controlling properties of haem proteins: structure/function relationships in archetypal systems and the development of an interdisciplinary methodology". Università degli studi di Firenze (Dpto Chimica). April 1999-Abril 2000. PI: Lucia Banci, CERM.

Patents

1. **Ruiz-Dueñas FJ**, Morales M, Rencoret J, Gutiérrez A, Del Río JC, Martínez MJ and Martínez AT 2008. Improved peroxidases (Spain) P200801292.
2. García E, Martínez MJ, **Ruiz Dueñas FJ**, Martínez AT and Alcalde M. 2009. High redox-potential peroxidases engineered by directed evolution (Spain) P200930157.

C.5. Stays in public or private R&D centres

- **Centro Risonanze Magnetiche** (CERM), Università degli studi di Firenze. Italy, 1999-2000. *Topic*: Nuclear Magnetic Resonance (NMR) in the postgenomic era. Copper trafficking in *Bacillus subtilis* (Postdoctoral stay).
- **Instituto Nacional de Engenharia e Tecnologia Industrial** (INETI). Lisbon, Portugal, 1994. Biochemical studies of cellobiose-oxidizing enzymes. Predoctoral research contract funded by the EU COMETT Programme on cooperation between universities and enterprises for training in the field of Biotechnology.