

Bastien Doumèche



Associate professor – Habilitate
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H-Index: 17 (Web of Science); 16 (Scifinder)

Author of 34 Articles, 2 review, 26 oral communications, 36 posters and 2 patents.

After biochemistry and biology studies in Rouen (France), I get my master degree in Amiens on a biocatalysis topic. I pursue this topic during my PhD at the RWTH-Aachen university (Germany) working on immobilized enzymes in two-phase systems under Prof. W. Hartemeier supervision. For my Post-doc I join the group of Dr. Rolland Furstoss and Dr. Alain Archelas at the CNRS in Marseille (France) to perform multi-gram scale biocatalysis using Epoxide Hydrolases. Then, I was temporary associate professor at the university of Cergy-Pontoise (France) working with Prof. Véronique Larreta-Garde on sol-gel transitions of protein-polysaccharides mixtures catalysed by enzymes.

At the University Lyon 1 (GEMBAS team of the ICBMS (UMR 5246 CNRS)) since 2006, I developed original research in heterogeneous biocatalysis (especially in the presence of ionic liquids) for the improvement of oxidoreductases, by protein chemistry, directed evolution and more recently cofactor engineering.

Currently, we focus on the development of **unique electrochemical screening methods**. Activities of a broad spectrum of oxidoreductases (dehydrogenases, oxidases, laccases) can be detected using 96 simultaneous electrochemical measurements in less than 1 minute. This system is currently used to identify enzymes optimized for biobatteries, enzyme inhibitors involved in certain cancers or to optimize environmental electrochemical biosensors.

The main topics in this fields are paper-based electrodes, enzyme immobilization, (bio)analytical chemistry together with associated technics (screen-printing and electrode manufacturing, enzymology, molecular biology...)

Main Scientific Involvements and Achievements

- ❖ Scientific coordinator the regional CEITOP Project: Electrochemical Screening of Inhibitors of Pathogens Tranketolases
- ❖ Partner in the ANR JCJC Transbioscreen (ANR-13-JSV5-0002)
- ❖ Novozymes Enzyme Assay Scientist Award (2014) for supervised PhD S. Abdellaoui
- ❖ PhD supervision (5 since 2009) and evaluation (8 since 2014)
- ❖ Reviewing activity (More than 300 since 2006) for several journals including Biosensors & Bioelectronics (IF 9.5), Green Chemistry (IF 9.4), Chemical communication (IF 6.1), RSC Advances (IF 3.0), Lab on a Chip (IF 6.9).
- ❖ Member of scientific societies: Bioelectrochemical society, French Chemical society (SCF), French Society of Biochemistry and Molecular Biology (SFBBM); French group of Bioelectrochemistry (GFB), French group of Biocatalysis (CBSO, Board)
- ❖ Member of the scientific board of national and international Conferences (HTCD2020, Biotrans 2023, CBSO 2016)
- ❖ Participation in 5 local and 4 external commissions for associate professors' recruitment since 2009
- ❖ Since 2023, I am **international mobility officer** promoting student mobility within Europa (Erasmus+) and other countries in the world (Specific agreements).

University cursus

2013	<i>Habilitation</i> Université Claude Bernard Lyon 1, Villeurbanne, France
1999-2002	<i>Doctoral Thesis in Biocatalysis and Enzymology bien »</i> Lehrsthule für Biotechnologie, RWTH-Aachen, Germany
1997-1999	<i>Master degree in Enzymatic Engineering, Microbiology and Bioconversion</i> Université de Picardie Jules Verne, Amiens, France
1994-1997	<i>Bachelor of Science in Molecular and Cellular</i> Université de Rouen, France

Academic Positions

Since 2006	Génie Enzymatique, Membranes Biomimétiques et Assemblages Supramoléculaires (GEMBAS) – ICBMS UMR CNRS 5246, Université de Lyon 1, France Associate Professor (Habilitation since november 2013) <i>Electrochemical Screening for bioelectronics, drug discovery, enzyme evolution</i> <i>Structure-Activity relationship in ionic liquids</i> <i>Enzyme kinetics of metabolic enzymes</i>
2004-2006	Equipe de Recherche sur les Relations Matrice Extracellulaire Cellules (ERRMECe), EA-1391, Université de Cergy-Pontoise, France Assistant Professor (Temporary) <i>Gelatine/polysaccharide hydrogels and enzymatic remodelling</i> Lab Director : Prof. Véronique Larreta-Garde
2003-2004	Groupe Biocatalyse et Chimie Fine (GBCF), UMR-CNRS 6111 (actuellement FRE-CNRS 2712), Faculté des Sciences de Luminy (Aix-Marseille II), France Post-doctoral fellowship <i>Engineering integrated biocatalysts for the production of chiral epoxides and other pharmaceuticals intermediates</i> Lab Director: Dr. Roland Furstoss
1999-2002	Lehrsthule Fur Biotechnologie, RWTH-Aachen, Germany <i>Fundamental phenomenological description and experimental optimisation of a gel-stabilized two-phase system in biocatalysis</i>

PhD Thesis

Lab Director: Prof Dr.-Ing. Winfried Hartmeier

Competencies

Protein Chemistry	<i>Enzyme Kinetics; Protein expression and Purification; Fluorescence spectroscopy; Enzyme assays (Colorimetric, electrochemical) ; Covalent modification of proteins; Electrophoresis (SDS-PAGE); Basic of molecular modelling</i>
Organic Chemistry	<i>Synthesis of small molecules (Ionic liquids, cofactors) and characterization by NMR (¹H, ¹³C, ³¹P) and mass spectrometry.</i>
Analytical Electrochemistry	<i>Cyclic voltammetry, chronoamperometry, intermittent pulsed amperometry; Electrochemical screening</i>
Various	<i>Screen-printed Electrode microfabrication on PCB and paper, profilometry.</i>

Research Contracts (5 last years)

2019-2023	Pack Ambition recherche 2019 financé par la région Auvergne-Rhône-Alpes, CEITOP (<i>Electrochemical screening of inhibitors of transketolase from pathogen</i>), 199 858 € . B. Doumèche Coordinator.
2021	Mars 2021 : Sanofi-Pasteur et UCBL- ICBMS UMR 5246 CNRS, <i>Enzyme activity measurement protocols (confidential)</i> , 84 108 € .

PhD & Post Doc Supervision

PhD	<p>2009-2011 : Mourad Bekhouche, « <i>Modifications chimiques et évolution dirigée de la formiate déshydrogénase de Candida boidinii : vers une compréhension de la relation structure/fonction d'une déshydrogénase en liquide ionique</i> », ICBMS-UMR 5246, Université Lyon 1, (taux d'encadrement 70 %, Directeur Prof. Loïc J. Blum).</p> <p>2010-2013 : Sofiène Abdellaoui, « <i>Déshydrogénases et laccases actives sur des surfaces redox : vers des applications en bioélectronique</i> », ICBMS-UMR 5246, Université Lyon 1, (taux d'encadrement 70 %, Directeur Prof. Loïc J. Blum).</p> <p>2013-2016 : Julie Carter, « <i>Nouveaux analogues de substrats de déshydrogénases pour le développement d'interfaces enzymes/électrodes innovantes</i> », ICBMS-UMR 5246, Université Lyon 1, (taux d'encadrement 50 %, Directeur Prof. Loïc J. Blum).</p> <p>2015-2018 : Chloé Aymard, « <i>Nouvelles méthodes électrochimiques pour le criblage d'inhibiteurs de transcétolases</i>», ICBMS-UMR 5246, Université Lyon 1 (Direction de la thèse Bastien Doumèche).</p> <p>2019-2023 : Nicolas Delprat, « <i>Biocapteurs enzymatiques sur support papier pour la détection d'herbicides</i> », ICBMS-UMR 5246, Université Lyon 1 (Direction de la thèse Bastien Doumèche 50%, co-encadrants Béatrice Leca-Bouvier et Guillaume Octobre, 25% chacun).</p> <p>2020-2024 : Numa Georges, « <i>Criblage électrochimique d'inhibiteurs de transcétolases d'organismes pathogènes</i> », ICBMS-UMR 5246, Université Lyon 1 (Direction de la thèse Bastien Doumèche, co-encadrant Franck Charmantray ICCF, UMR 6296)</p>
Post-Doc	<p>Fév. 2018-Sept. 2019 : Usama Hegazy ; "Novel high throughput screening electrochemical assay for biomass digesting enzymes", ICBMS-UMR 5246, Université Lyon 1, Egypt-France Cooperation Program (STDF-IFE)</p> <p>Mars 2019-Déc.2019 : Romain Clément ; « <i>Biocapteur électrochimique pour la détection du parasite de la Malaria</i> », ICBMS-UMR 5246, Université Lyon 1, Projet porté par Stéphane Picot (équipe SMITH de ICBMS-UMR 5246) Financement de la société Magnetrap.</p>

PUBLICATIONS OF THE LAST FIVE YEARS (10)

- [A1]. Georges, R.-N., Ballut, L., Aghajari, N., Hecquet, L., Charmantray, F., Doumèche, B.*, *Biochemical, bioinformatic and structural comparisons of transketolases and the position of Human transketolase in the enzyme evolution*. *Biochemistry*. DOI: 10.1021/acs.biochem.3c00714
- [A2]. Georges, R.-N., Ballut, L., Octobre, G., Comte, A., Hecquet, L., Charmantray, F., Doumèche, B.* **2024**. *Structural determination and kinetic analysis of the Transketolase from Vibrio vulnificus reveal unexpected cooperative behavior*. *Prot. Sci.* 33(3): e4884. DOI: 10.1002/pro.4884
- [A3]. Maucourt, F., Doumèche, B., Nazaret, S., Fraissinet-Tachet, L.* **2024**. *Underexplored roles of microbial ligninolytic enzymes in aerobic polychlorinated biphenyl transformation*. *Environ. Sci. Pollut. Res. Int.* 31: 19071-19084. DOI: 10.1007/s11356-024-32291-4
- [A4]. Fall I., Doumèche, B., Abdellaoui, S., Rémond, C., Rakotoarivonina, H., Ochs, M.* **2024**. *Paper-based electrodes as a tool for detecting ligninolytic enzymatic activities*. *Bioelectrochemistry*. 156: 108609. DOI: 10.1016/j.bioelechem.2023.108609
- [A5]. Delprat N., L.O. Martins, L.J. Blum, C.M.G. Aymard, B.D. Leca-Bouvier, G.G.R. Octobre, B. Doumèche*, **2023**. *User-friendly one-step disposable signal-on bioassay for glyphosate detection in water samples*. *Biosens. Bioelectron.* 241: 115689 DOI: 10.1016/j.bios.2023.115689
- [A6]. Maucourt, F., Doumèche, B., Chapulliot, D., Vallon, L., Nazaret, S., Fraissinet-Tachet, L., **2023**, *Polychlorinated biphenyl transformation, peroxidase and oxidase activities of fungi and bacteria isolated from a historically contaminated site*. *Microorganisms*. 11(8): 1887. DOI: 10.3390/microorganisms11081887
- [A7]. Fall I., Q. Czerwiec, S. Abdellaoui, B. Doumèche, M. Ochs, C. Rémond, H. Rakotoarivonina, **2023**. *Characterisation of a new bacterial catalase-peroxidase from Thermobacillus xylanilyticus and investigation of its ligninolytic potential by electrochemistry*. *Appl. Microbiol. Biotechnol.* 107: 201-217. DOI: 10.1007/s00253-022-12263-9
- [A8]. Conchou L., B. Doumèche, F. Galisson, S. Violot, C. Dugelay, E. Diesis, A. Page, A.-L. Bienvenu, S. Picot, N. Aghajari, L. Ballut, **2022** *Structural and molecular determinants of Candida glabrata metacaspase maturation and activation by calcium*. *Commun. Biol.* 5: 1158. DOI: 10.1038/s42003-022-04091-4.
- [A9]. Clément, R., A.-L. Bienvenu, A. Lavoignat, G. Bonnot, B. Doumèche, S. Picot, **2022**. *Paper functionalization for detection of Plasmodium falciparum DNA using square waves voltammetry*. *Talanta* 252(15): 13839. DOI: 10.1016/j.talanta.2022.123839.
- [A10]. Buchet, R., C. Tribes, V. Rouaix, B. Doumèche, M. Fiore, Y. Wu, D. Magne, S. Mebarek, **2021**. *Hydrolysis of extracellular ATP by vascular smooth muscle cells transdifferentiated into chondrocytes generates P_i but not PP_i*. *Int. J. Mol. Sci.* 22(6): 2948-2964. DOI: 10.3390/ijms22062948.

REVIEWS & BOOK CHAPTER OF THE LAST FIVE YEARS (2)

- [R1]. Octobre, G., Delprat, N., Doumèche, B., Leca-Bouvier, B.*, **2023**, *Herbicide detection: a review of enzyme- and cell-based biosensors*. *Environ. Res.* 249 : 118330. DOI : 10.1016/j.envres.2024.118330
- [R2]. Leca-Bouvier, B.*, B. Doumeche and L.J. Blum, **2019**. *Enzymatic assays (Chapter 12) In Analytical Electrogenerated Chemiluminescence: From Fundamentals to Bioassays*, edited by Neso Sojic, Royal Society of Chemistry; 1st edition (November 19, 2019), 492 p.(331 – 385). DOI: 10.1039/9781788015776-00331

PATENTS (2)

- [P1]. Picot S., Doumèche B., Bienvenu A.-L., *Method for detection of coronavirus replication*, FR3123658 (2022-12-09), WO2022254164 (2022-12-08)
- [P2]. Picot S., Clément R., Doumèche B., Bienvenu A.-L., Moniotte N., Derenne A., Hubinon F., Chatellier S., *Device for detecting the presence of at least one target DNA and/or at least one target RNA in a sample, in particular in a liquid sample*, WO2021144374 (2021-01-14)