



CURRICULUM VITAE – ULRICH ECKHARD

CV date 06/10/2022

Part A. PERSONAL INFORMATION

First name	Ulrich	Birth date (dd/mm/yyyy)	11/12/1982
Family name	Eckhard	Gender	Male
ID number (NIE)	Y7570115-R	Children (DOB)	1 (05/04/2022)
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Open Researcher and Contributor ID (ORCID)	0000-0001-5863-4514		

A.1. Current position

Position (from)	Ramon y Cajal Research Investigator (01/09/2022), RYC2020-029773-I		
Department, Institution, Center	Department of Structural and Molecular Biology, Molecular Biology Institute Barcelona (IBMB), Consejo Superior de Investigaciones Científicas (CSIC)		
City, Country	Barcelona, Spain	Telephone number	+34 93 4020187
Funding	PID2021-128682OA-I00. Plan Estatal de Investigación Científica, Técnica y de Innovación		
Keywords	Proteolytic enzymes, structural biochemistry, synthetic microbiology, enzymatic flagellins, functionalization of bacterial flagella for biotechnology & biomedicine.		

A.2. Previous positions

Period	Position/Institution/Country
10/2019 to 08/2022	Post-doctoral fellow, IBMB-CSIC, Barcelona, Spain.
10/2017 to 09/2019	Post-doctoral fellow, University of Salzburg, Austria.
09/2016 to 09/2017	Post-doctoral researcher, Uppsala University, Sweden.
05/2012 to 08/2016	Post-doctoral fellow, University of British Columbia, Vancouver, Canada.
11/2007 to 04/2012	PhD Student/Post-doc, University of Salzburg, Austria.

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
PhD in Natural Sciences	University of Salzburg, Austria.	2011
MSc Molecular Biology	Universities of Salzburg and Linz, Austria.	2011
MSc Biology	University of Salzburg, Austria.	2007
BSc Molecular Biosciences	Universities of Salzburg and Linz, Austria.	2006
BSc Biology	University of Salzburg, Austria.	2005

A.4. Accreditations

Certification Body	University/Country	Year
AQU Catalunya	Acreditación de Profesorado Lector	2022
AQU Catalunya	Acreditación de Investigación	2022

Part B. CV SUMMARY

During my PhD in the lab of [Prof. Hans Brandstetter](#) at the University of Salzburg, I focused on the biochemical and structural characterization of clostridial collagenases, resulting in 6 peer-reviewed articles, including first-author publications in *The Journal of Biological Chemistry* and *Nature Structural & Molecular Biology*. Despite my young age, I was the main driver of the project, and I succeeded in solving the long-standing puzzle of clostridial collagenolysis by determining the crystal structure of collagenase G and a key accessory domain, and I deposited a total of 10 crystal structures to the Protein Data Bank, including the very first one of clostridial collagenases and several inhibitor complexes.

In May 2012, I joined the protease degradomics lab of [Prof. Chris Overall](#) at the UBC Centre for Blood Research in Vancouver, where I focused on proteomics whilst staying in close contact with protease research. Funded by a post-doctoral fellowship, I mastered several cutting-edge mass spectrometry-based techniques and contributed to multiple interdisciplinary and highly collaborative projects. For example, I developed a MALDI-TOF based bradykinin release assay, profiled clostridial collagenases, and lead the herculean task to profile human MMPs. Furthermore, by using positional proteomics, I



assessed the proteome and N-terminome of human pulp and contributed to the degradomic analysis of human platelets and murine pancreatic tumors. Moreover, I established a strong collaboration with [Prof. Andrew C. Doxey](#), University of Waterloo, that led to the discovery of a family of bacterial flagellins with proteolytic activity, and we are looking into their impact on bacterial lifestyle and biofilm biology, and the possibility to use enzymatic hybrid flagella for biotechnology and biomedicine.

In September 2016, I joined the lab of [Prof. Maria Selmer](#) at Uppsala University, Sweden, within a newly started protein evolution project where I tackled the overarching question of how protein structure and function are intertwined. My main project focused on the characterization of various Atlantic and Baltic herring proteins that had been identified by population-scale sequencing to be involved in ecological adaptation. I solved the crystal structures of both Atlantic and Baltic phosphoglucosyltransferase 5, and corroborated our findings using techniques such as SAXS, circular dichroism, and differential scanning fluorimetry. Furthermore, I assisted in the enzymatic characterization of a phage-encoded SAM-hydrolase, solved its apo structure, and determined with an Erasmus+ student the crystal structure of two HisA variants of *Salmonella enterica* with divergent substrate specificities.

In 2017, I secured a prestigious two-year grant from the Peter and Traudl Engelhorn Foundation, allowing me to start my own research project at the Structural Biology Lab of [Prof. Hans Brandstetter](#). I succeeded in the expression and purification of various active and inactivated flagellinolytic variants and performed comprehensive biochemistry. While more structural studies are ongoing, I recently solved the very first crystal structures of their proteolytic domains, including a complex with the small molecule inhibitor actinonin. These structures guide now my enzymatic hybrid designs for flagellar display. Furthermore, I focused on a heterogenous and highly peculiar family of U32 collagenases, and established proteomic-based protease profiling as a key technology at our department.

In 2019, I was awarded a 3-year Beatriu de Pinós post-doctoral fellowship to join the Proteolysis Lab of [Prof. Xavier Gomis-Rüth](#) at IBMB-CSIC in Barcelona, Spain, where I continued my research in structural biochemistry and extended my methodological repertoire to cryo-EM, and solved the complex structure of the human sheddase meprin and its endogenous inhibitor fetuin-B. Currently, I am establishing my own research line as a [Ramon y Cajal Research Investigator](#) (2022-2027) at the interface of molecular biochemistry, structural biotechnology, and synthetic microbiology to redesign proteolytic flagellins and to use flagellar display for biotechnological and biomedical applications.

To date, I have published 41 peer-reviewed papers, 18 as (shared) first and three as (co) corresponding author, including articles in Nature Structural & Molecular Biology (Eckhard et al. 2011), Nature Communications (Eckhard et al. 2017), and PNAS (Eckhard et al. 2021). Based on the [Scopus](#), I have an h-index of 20 with over 1330 citations for 39 documents, a cumulative impact factor of >300, and an i10-index in [Google Scholar](#) of 29. Additionally, I frequently participate in academic teaching and have, in addition to hosting visiting research fellows, supervised and mentored students at all levels. For example, since January 2022, I have hosted and supervised 3 Master and two Erasmus+ students, and I am currently co-directing two PhD students, with one defending end of October.

Part C. RELEVANT MERITS

C.1. Publications Summary. Please refer to [PubMed](#) or [ResearchGate](#) for a complete list of publications.

	Scopus	Web of Science	Google Scholar
Peer-reviewed articles	39	37	41
Total number of citations	1334	1242	1760
Average number of citations	34.2	33.6	42.4
Average number of citations per year	74.1	69.0	97.7
h-index	20	19	22
i10-index	-	-	29

C.2. Publications. The 10 most relevant publications of the last 5 years are stated (out of 18).

*Contributed Equally, #Corresponding Author

Jimenez-Alesanco A*; **Eckhard U***; ...; Abian O (2/8). **2022**. Repositioning small molecule drugs as allosteric inhibitors of the BFT-3 toxin from enterotoxigenic *Bacteroides fragilis*. Protein Science, [31\(10\):e4427](#).



- Chidyausiku TM; Mendes SR; Klima JC; Nadal M; **Eckhard U**; ...; Marcos E (5/14). **2022**. De novo design of immunoglobulin-like domains. *Nature Communications*, [13\(1\):5661](#).
- Del Amo-Maestro L; ...; **Eckhard U**, Gomis-Rüth FX; (10/11). **2022**. Molecular and in vivo studies of a glutamate-class prolyl-endopeptidase for coeliac disease therapy. *Nature Communications*, [13\(1\):4446](#).
- Mendes SR; **Eckhard U**[#]; ...; Vilcinskas A[#], Gomis-Rüth FX[#]; (2/8). **2022**. An engineered protein-based submicromolar competitive inhibitor of the *Staphylococcus aureus* virulence factor aureolysin. *Computational and Structural Biotechnology Journal*, [20:534–544](#).
- Eckhard U**^{*}; Körschgen H^{*}; ...; Gomis-Rüth FX (1/5). 2021. The crystal structure of a 250-kDa heterotetrameric particle explains inhibition of sheddase meprin β by endogenous fetuin-B. *PNAS*, [118\(14\), e2023839118](#).
- Godoy-Gallardo M; **Eckhard U**; ...; Perez RA (2/7). **2021**. Antibacterial approaches in tissue engineering using metal ions and nanoparticles: From mechanisms to applications. *Bioactive Materials*, [6\(12\):4470-4490](#).
- Eckhard U**[#]; ...; Doxey AC[#]; Brandstetter H (1/7). **2020**. Identification and characterization of the proteolytic flagellin from the common freshwater bacterium *Hylemonella gracilis*. *Scientific Reports*, [10\(1\):19052](#).
- Dufour A; Bellac CL; **Eckhard U**; ...; Overall CM (3/14). **2018**. C-terminal truncation of IFN- γ inhibits proinflammatory macrophage responses and is deficient in autoimmune disease. *Nat Commun*, [20:9\(1\):2416](#).
- Tharmarajah G; **Eckhard U**; ...; Van Raamsdonk CD (2/10). **2018**. Melanocyte development in the mouse tail epidermis requires the Adamts9 metalloproteinase. *Pigment Cell & Melanoma Research*, [31\(6\), 693-707](#).
- Klein T; **Eckhard U**; ...; Overall CM (2/5). **2018**, Proteolytic cleavage: Mechanisms, function “omic” approaches for a near ubiquitous posttranslational modification, *Chemical Reviews*, [118\(3\), 1137-1168](#).

C.3. Conferences. The 5 most relevant conference contributions of the last 5 years are stated.

Co-chair at the “Pathogens” session of the 39th Winter School on Proteinases and their Inhibitors. Virtual. **Best Chairing Award**.

Bloch E, Jenkins BGL, Doxey AC, **Ulrich Eckhard**. **2021**. Expanding the modularity of proteolytic flagellins to generate versatile superhero bugs. **Oral presentation**. XXVII Molecular Biology Meeting, Barcelona, Spain.

Eckhard U, Bandukwala H, Mansfield MJ, Marino G, Wallace I, Holyoak I, Austin J, Overall CM, Doxey AC. **2018**. Bacterial Flagella in the Moonlight of Proteolysis. **Oral presentation**. **Runner-up for Best Oral Presentation**. 22nd Swedish Conference on Macromolecular Structure and Function. Tällberg, Sweden.

Eckhard U, Doxey AC, Overall CM, Brandstetter H. **2018**. Extracellular microbial hydrolases – promising targets and agents to overcome antimicrobial resistance. **Oral presentation**. Department of Biotechnology and Biomedicine, Technical University of Denmark, Lyngby, Denmark.

Eckhard U, Bandukwala H, Huesgen PF, Schönauer E, Brandstetter H, Doxey AC, Overall CM. **2017**. From clostridial collagenases to proteolytic flagella via structural biology and proteomics. **Oral presentation**. Department of Microbiology, University of Manitoba, Winnipeg, Canada.

C.4. Research projects and acquired funding.

Project title: Redesigning bacterial flagella to harbor functional domains for biotechnology and biomedicine (Flagella 3.0).

Financing entity: Agencia Estatal de Investigación **Grant reference:** PID2021-128682OA-I00

Amount granted: 127,050 EUR **Affiliation:** IBMB-CSIC, Barcelona.

Duration: from 2022 to 2025 **Lead researcher:** **Ulrich Eckhard**

Ramón y Cajal Research Investigator (2022-2027), Biociencias y Biotecnología.

Financing entity: Agencia Estatal de Investigación **Grant reference:** RYC2020-029773-I

Amount granted: 324,250 EUR **Affiliation:** IBMB-CSIC, Barcelona.

Duration: from 01.09.2022 to 31.08.2027 **Lead researcher:** **Ulrich Eckhard**

Project title: Functional analysis of the interplay between von-Willebrand-Factor and the specific metallopeptidase ADAMTS13.

Financing entity: Beatriu de Pinós COFUND Program **Grant reference:** 2018BP00163

Amount granted: 144,300 EUR **Affiliation:** IBMB-CSIC, Barcelona.

Duration: from 01.02.2020 to 31.08.2023 **Lead researcher:** **Ulrich Eckhard**

Project title: Proteolytic flagella – from bioinformatics to proteomics & structural biology.

Financing entity: Peter and Traudl Engelhorn Foundation **Grant reference:** PTES-2016

Amount granted: 134,773 EUR **Affiliation:** University of Salzburg, Austria.



Duration: from 01.10.2017 to 30.09.2019 **Lead researcher:** Ulrich Eckhard

Project title: Proteolytically active flagellins expand the functional repertoire of bacterial flagella.

Financing entity: UBC Centre for Blood Research **Grant reference:** CBR PDF 2016

Amount granted: 3,500 CAD **Affiliation:** UBC Centre for Blood Research, Canada.

Duration: from 01.05.2016 to 30.05.2016 **Lead researcher:** Ulrich Eckhard

Project title: Placental proteomics: protease networks to identify biomarkers for preterm labor.

Financing entity: Michael Smith Foundation for Health Research **Grant reference:** MSFHR RT 5437

Amount granted: 124,000 CAD **Affiliation:** UBC Centre for Blood Research, Canada.

Duration: from 01.09.2013 to 31.08.2016 **Lead researcher:** Ulrich Eckhard

C.5. Technology transfer and partnership projects with companies.

Development of a Real-time PCR assay for genotyping the polymorphism causing lactose intolerance at the Central Hospital of Steyr, Austria (2005). This assay now routinely complements the hydrogen breath test, was successfully outsourced, and is now available at *ratiogen AG* ([Publication](#) | [Product](#)).

Structural and biochemical characterization of the proteolytic enzyme lysargiNase, which exquisitely complements trypsin in proteomic experiments, and is thus in great demand worldwide (2014). This led to the outsourcing of the protein to the *Merck Group* ([Publication](#) | [Product](#)).

Since joining the Proteolysis Lab at IBMB-CSIC, I was critically involved in the biochemical and structural characterization of the plant prolyl-endopeptidase neprosin, which is capable of cleaving the highly-immunogenic 33mer of α -gliadin, the main causative of celiac disease (del Amo Maestro et al. 2022, [Nature Communications](#)). We are now in contact with a biotech company for enzyme formulation and commercialization, and we are in the process of patenting one of our improved protease variants.

Finally, together with our IBMB-CSIC collaborator [Enrique Marcos](#) and researchers from the Institute for Protein Design at the University of Washington, we recently filed a patent for *de novo* designed immunoglobulin-like domains (Patent Application 63/316,733), and our corresponding research paper was published just this month (Chidyausiku et al. 2022, [Nature Communications](#)).

C.6. Supervision of Erasmus+, Master, and PhD students since moving to the IBMB-CSIC (10/2019).

Since joining the IBMB-CSIC in fall 2019, and in addition to bench supervision of scientists at all levels, I have been officially involved in the supervision and mentoring of the following students:

PhD Students (Co-Director):

- Soraia dos Reis Mendes (University of Barcelona; defending in October 2022)
- Juan Sebastián Ramírez Larrota (University of Barcelona; since October 2021)

Master Students:

- Kawtar Ben Larbi (University of Barcelona; March 2022 to September 2022).
- Laura Garzón Flores (Pompeu Fabra University, Barcelona; January 2022 to July 2022)
- Mayra Loayza Saldaña (Pompeu Fabra University, Barcelona; January 2022 to July 2022)

Erasmus+ Program:

- Alea Radcke (University of Bonn, Germany; August 2022 to October 2022)
- Ariana Ivanić (University of Zagreb, Croatia; March 2022 to August 2022)

C.7. Academic committee work and Peer-reviewing

Elected student representative for Molecular Biology (2004-2006) and Biology (2006-2008), and member of the respective Curriculum Committees (2002-2006; 2006-2008). Representative of the mid-level academic faculty in search and hiring committees (e.g., Microbiology, Analytical Chemistry, Organic Chemistry), and member of various study program evaluation and development panels.

Ad hoc reviewing for (e.g.): *Nature Communications*, *Proceedings of the National Academy of Sciences*, *Frontiers in Microbiology*, *Journal of Proteome Research*, *Biochemie*, *FEBS Journal*, *Journal of Proteomics*, *Applied and Environmental Microbiology*, *Molecular & Cellular Proteomics*, *Journal of Experimental Botany*, *Journal of Molecular Biology*, *PLOS Computational Biology*, and *BMC Biology*.