CV Date	26/06/2025

Part A. PERSONAL INFORMATION

First Name	Carolina
Family Name	Sousa Martín

A.1. Current position

Job Title	Catedrática de Universidad		
Starting date	2012		
Institution	Facultad de Farmacia. Universidad de Sevilla		
Department / Centre	Microbiología y Parasitología		
Country	Spain		
Keywords	Digestive immunopathologies, gluten-related disorders, gluten immunogenic peptides, biomarkers, immunotoxicity		

A.4. General quality indicators of scientific production

My research activity is reflected in a total of **five six-year research evaluation periods** (sexenios), with the **most recent granted in 2021** (covering the period 2016–2021), and **one six-year period in technology transfer.** I have participated in 43 research projects, acting as Principal Investigator (PI) in 22, as well as in **20 contracts with companies (PI in 17)**, and 18 clinical trials (both national and international).

This work has resulted in over 120 publications indexed in JCR, with a total of 4,321 citations according to Scopus (excluding self-citations). In the last five years, 72.41% of these publications were in first quartile (Q1) journals, and the average number of citations per year over the same period has been 424, also based on Scopus.

I have contributed to more than 200 presentations at national and international conferences, and I am **co-inventor of four internationally extended and licensed patents, with technology transfer agreements involving government agencies and companies in the technological, agri-food, and health sectors. Several of these patents have been cited by more than five international patents, reflecting their value as foundational technologies. Techniques derived from my research have been incorporated into national and international protocols and clinical guidelines.**

Over the past 10 years, I have supervised **11 doctoral theses**, 9 in academic research and **2 in industrial research.** All PhD candidates have published between 3 and 10 JCR-indexed articles during their doctoral training, with 70% of these publications appearing in Q1 journals.

Part B. CV SUMMARY

As Principal Investigator, I lead a globally recognized research group specialized in celiac disease and digestive immunopathologies. I established a highly interdisciplinary team that has enabled impactful **collaborations with national and international companies such as Active Motif (EE. UU.), Biomedal S.L. (Spain), and Hygiena Topco LLC (EE. UU.)**, among others. This collaborative framework has resulted in major achievements in translational research and technology transfer:

• Development of immunological methods to quantify the toxic potential of gluten in food and raw materials intended for individuals with gluten-related disorders.

These analytical techniques have been **commercialized under the GlutenTox® trademark by Biomedal S.L.**, with product lines including GlutenTox Sticks (KT-4711), Sticks Plus (KT-5340), Home (KT-5000), Competitive ELISA (KT-4758), and Sandwich ELISA (KT-5196). Among these, **GlutenTox® Pro became the top-selling product in its category worldwide in 2018. A key milestone in the technology transfer pathway was reached in 2018, when the U.S., based company Hygiena Topco LLC acquired this business unit from Biomedal S.L., responsible for commercializing the diagnostic products developed through this research. This acquisition led to the establishment of the Spanish subsidiary Hygiena Diagnóstica España S.L., a strategic move that anchored high-value biotech activity in Spain, enabled global distribution through more than 80 distributors in over 190 countries, and drove a 25% increase in local employment.**

• Characterization of the immunotoxic potential of oats, leading to the development of methods for selecting safe varieties for patients with celiac disease and related conditions.

This research was **patented (P201001632 / ES2385463 A1 / PCT ES2011 000378) and led to modifications in food safety legislation at both the national and international levels**. The results were published in the journal Gut and selected by Faculty of 1000 as among the top 2% of scientific publications in medicine and biology worldwide.

• Development of a **non-invasive biomarker for detecting gluten intake in stool and urine**, enabling the control of intestinal and extraintestinal symptoms and the prevention of oncological complications. These techniques allow for gluten exposure monitoring even prior to diagnosis, evaluation of compliance with gluten-free diets, and support for future non-dietary therapies. The methods were **patented (P201001633 / ES2385455B2 / PCT ES2011 000379 and P201400569 / ES2556177B1 / PCT ES2015 070536) and led to the creation of the VYDAL In Vitro Diagnostics® product line (all CE-marked under Directive IVDD 98/79/EC and ISO 13485 certified),** including both professional and home-use products: Ivycheck GIP Stool (KT-5737), Ivycheck GIP Urine (KT-6412, KT-6411), Ivycheck Reader (AP-5856), Ivylisa GIP Stool (KT-5738) and Gluten Detect Stool Test (KT-6355, KT-6416, KT-6414).

These technologies have been used by leading biopharmaceutical companies such as **Sanofi, Novartis,** and **ImmunogenX** in clinical trials aimed at developing new therapies for celiac disease. They are currently implemented in over **50 hospitals and clinical laboratories worldwide**, including **Synlab** and **Eurofins**, and have been **incorporated into the Spanish National Health System, protocols** of the Spanish Ministry of Health, and **clinical guidelines** (**national and international**) of the Spanish Society for Celiac Disease (SSEC), the American Gastroenterological Association (AGA), and the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN).

This research has fostered collaborations with top-tier academic institutions such as **Harvard and Stanford** and was recently highlighted in a *Nature Reviews Gastroenterology & Hepatology* publication as one of the most significant milestones in the history of allergen-related diseases. It has also inspired new research lines at Stanford University, leading hospitals, and biotech companies. Ongoing studies include:

• Peptidomic analysis of gluten peptides in urine via mass spectrometry in healthy individuals and celiac patients.

• Use of gluten peptides as diagnostic probes for detecting antigens in human fluids such as amniotic fluid.

• Clinical trials evaluating intestinal permeability in digestive pathologies with inflammation, such as irritable bowel syndrome, among others.

Part C. RELEVANT ACCOMPLISHMENTS

C.1. Publications

AC: corresponding author. (nº x / nº y): position / total authors. Quartile (Q), Decile (D), and Impact Factor (IF).

1 **Scientific paper**. Moreno, Maria de Lourdes; Gonzalez-Rovira, Maria; Martinez-Pancorbo, Cristina; et al; (14/14) **Sousa, Carolina** (AC). 2024. Foetal gluten immunogenic peptides during pregnancy: a new determinant on the coeliac exposome. BMC MEDICINE. BIOMED CENTRAL LTD; BMC (BioMed Central); BMC. 22-1. ISSN 1741-7015. https://doi.org/10.1186/s12916-024-03495-9. **Q1/D1, IF 7.1 (JCR).**

2 **Scientific paper**. Palanski, Brad A.; Weng, Nielson; Zhang, Lichao; et al; Elias, Joshua E.; (8/11) **Sousa, Carolina**. 2022. An efficient urine peptidomics workflow identifies chemically defined dietary gluten peptides from patients with celiac disease. NATURE COMMUNICATIONS. NATURE PUBLISHING GROUP; NATURE PORTFOLIO. 13-1. ISSN 2041-1723. https://doi.org/10.1038/s41467-022-28353-1. **Q1/D1, IF 16.6 (JCR).**

3 **Scientific paper**. Fernández-Bañares, Fernando; Beltrán, Belén; Salas, Antonio; et al; (16/16) **Sousa, Carolina**. 2021. Persistent villous atrophy in De novo adult patients with celiac disease and strict control of gluten-free diet adherence: a multicenter prospective study (CADER study). AMERICAN JOURNAL OF GASTROENTEROLOGY. NATURE PUBLISHING GROUP; LIPPINCOTT WILLIAMS & WILKINS. 116-5, pp.1036-1043. ISSN 0002-9270, ISSN 1572-0241. https://doi.org/10.14309/ajg.0000000000001139. **Q1/D1, IF 12.045 (JCR).**

4 **Scientific paper**. Silvester, Jocelyn A.; Comino, Isabel; Kelly, Ciarán P.; et al; Weiten, Dayna; (4/15) **Sousa, Carolina**. 2020. Most patients with celiac disease on gluten-free diets consume measurable amounts of gluten. GASTROENTEROLOGY. W B SAUNDERS CO-ELSEVIER INC. 158-5, pp.1497-1499.e1. ISSN 0016-5085, ISSN 1528-0012. https://doi.org/10.1053/j.gastro.2019.12.016. **Q1/D1, IF 22.682 (JCR).**

5 **Scientific paper**. Comino, Isabel; Segura, Verónica; Ortigosa, Luis; et al; (15/15) **Sousa, Carolina** (AC). 2019. Prospective longitudinal study: use of faecal gluten immunogenic peptides to monitor children diagnosed with coeliac disease during transition to a gluten-free diet. ALIMENTARY PHARMACOLOGY & THERAPEUTICS. WILEY; WILEY-BLACKWELL. 49-12, pp.1484-1492. ISSN 0269-2813, ISSN 1365-2036. https://doi.org/10.1111/apt.15277. **Q1/D1, IF 9.566 (JCR).**

6 **Scientific paper**. Moreno, Mariá De Lourdes; Cebolla, Ángel; Munõz-Suano, Alba; et al; (9/9) **Sousa, Carolina** (AC). 2017. Detection of gluten immunogenic peptides in the urine of patients with coeliac disease reveals transgressions in the gluten-free diet and incomplete mucosal healing. GUT. BMJ PUBLISHING GROUP. 66-2, pp.250-257. ISSN 0017-5749, ISSN 1468-3288. https://doi.org/10.1136/gutjnl-2015-310148. **Q1/D1, IF 17.016 (JCR).**

C.2. Research projects and contracts

Competitive Research Projects

1. Project PID2023-147757OB-I00. *Evaluation and development of novel biomarkers for detecting alterations in intestinal permeability associated with inflammatory and functional disorders.* Ministry of Science, Innovation and Universities. **Sousa Martín, Carolina**. 01/09/2024–31/12/2027. €168,750.
2. Project RTC2019-6806-1 (CELISIN) – *New high-precision methods for the diagnosis of gluten intolerance.* Ministry of Science and Innovation. **Sousa Martín, Carolina**. 01/01/2020–30/06/2023. €322,756.50.
3. Project US-15332 – *Nutripeptidomics of amniotic fluid and its implications in gluten-related pathologies.* Regional Government of Andalusia (Ministry of Economy and Knowledge). **Sousa Martín, Carolina**. 01/02/2020–30/04/2022. €90,000.
4. Project SAF2017-83700-R – *Gluten metabolomics: Characterization and study of patterns of immunogenic gluten peptides excreted in urine from patients with gluten-related disorders.* Ministry of Economy and Competitiveness. **Sousa Martín, Carolina**. 01/01/2018–30/09/2021. €144,716.
5. Project RTC-2016-5441-1 (Univertest) – *Development of a universal platform for rapid design and validation of lateral flow immunoassays.* Ministry of Economy and Competitiveness. **Sousa Martín, Carolina**. 01/09/2016–30/04/2019. €156,510.
6. Project RTC-2016-5452-1 (Urinestest) – *Rapid methods for the analysis of immunogenic food peptides in urine.* Ministry of Economy and Competitiveness. **Sousa Martín, Carolina**. 01/09/2016–30/04/2019. €124,350.

Contracts with companies and Institutions

7. Contract – GUTBARRIER: *Development of methods for assessing intestinal permeability to food antigens.* **Sousa Martín, Carolina**. 15/03/2023–16/06/2026. €87,218.08.
8. Contract: *Development of recombinant antibodies for diagnosis, monitoring and therapy of celiac disease.* **Sousa Martín, Carolina**. 15/02/2022–15/03/2024. €34,215.17.

9. Contract – ATHAME: *Development of analytical methods for determining corticosteroid drug metabolites for treatment monitoring.* **Sousa Martín, Carolina**. 10/06/2019–30/11/2022. €149,529.38.
10. Contract – GIPROTEC: *Comprehensive assessment of dietary adherence and mucosal status using combined analysis of gluten immunogenic peptides (GIP) and calprotectin in stool samples from celiac patients.* **Sousa Martín, Carolina**. 15/02/2018–01/01/2020. €60,893.42.
11. Contract – GLUTENDETECT: *Home-use test for gluten-free diet monitoring.* **Sousa Martín, Carolina**. 11/12/2017–01/01/2020. €66,550.
12. Contract – ALERGOTEST: *Development and implementation of methodologies for detecting food allergens and immunogenic peptides via immunoassays, PCR, and mass spectrometry.* **Sousa Martín, Carolina.** 25/11/2016–25/11/2019. €84,700.

C.3. Technology transfer and exploitation of results

1. Invention Patent: Moreno Amador, María de Lourdes; **Sousa Martín, Carolina**; Rodríguez Herrera, Alfonso; Cebolla Ramírez, Ángel. *Detection of gluten peptides in human fluids.* ES2556177B1, P201400569 / PCT/ES2015/070536. 13/10/2016.
2. Invention Patent: **Sousa Martín, Carolina**; Comino Montilla, Isabel; Real Calderón, Ana; Vivas Alegre, Santiago; Cebolla Ramírez, Ángel. *Determination of levels of immunogenic gluten peptides in human samples.* ES2385455B2, P201001633 / PCT/ES2011/000379. 13/09/2013.
3. Invention Patent: Comino Montilla, Isabel; Real Calderón, Ana; **Sousa Martín, Carolina**. *Procedure for the selection of cereal seeds suitable for consumption by celiac patients.* ES2385463B1, P201001632 / PCT/ES2011/000378. 27/05/2013.
4. Invention Patent: Cebolla Ramírez, Ángel; **Sousa Martín, Carolina**; de Lorenzo Prieto, Víctor. *Gene overexpression method regulated by a cascade genetic circuit.* PCT/IB2000/00830, 22/06/1999.

These patents enabled the development of innovative methods and products, including CASCADE™, a gene overexpression system regulated by a cascade genetic circuit. This pioneering synthetic biology innovation paved the way for technology transfer. Building on subsequent patents, I developed methods and products that have transformed the detection, monitoring, and management of gluten-related disorders: the GlutenTox® line for food safety and VYDAL® In Vitro Diagnostics for clinical applications. These technologies have driven a global transformation in the food industry, adopted by leading laboratories, national healthcare systems, and international hospitals. As a result, they have enhanced global technology transfer, established new standards in international clinical guidelines, and consolidated Spanish leadership in the biotechnology, food industry, and healthcare sectors.

C.4. National and international awards received

1. **FAMA-US Research Career Award in Health Sciences (2022)**. Awarded by the University of Seville in recognition of an outstanding trajectory in biomedical research.
2. **Research Award from the Spanish Foundation for Digestive Diseases (FEAD) (2020)**. Granted for scientific excellence in gastrointestinal research and clinical innovation.
3. **2nd Knowledge Transfer Award – University of Seville (2019)**. In recognition of exemplary impact in transferring scientific knowledge to industry and clinical practice.
4. **6th Losada Villasante Award for Excellence in Innovation (2018).** Awarded for leading technological innovation in health-related research.
5. **Research Prize from the Andalusian Society of Clinical Analysis and Laboratory Medicine (2017)**. Granted for contributions to translational diagnostics in laboratory medicine.
6. **Ibero-American Academy of Pharmacy Award (2014)**. In recognition of scientific contributions to pharmaceutical innovation.
7. **Research Award from the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) (2012)**. Awarded for outstanding research in paediatric gastroenterology and immune-mediated disorders.
8. **Federation of European Nutrition Societies (FENS) Research Award (2011)**. Granted for excellence in European nutrition science related to intestinal health.
9. **6th National Research Award on Celiac Disease (2008)**. Awarded for translational impact in diagnostics and immunopathology of celiac disease.
10. **1st National Research Award on Celiac Disease (2003)**. Pioneering recognition for early contributions to the pathophysiology of gluten-related disorders.