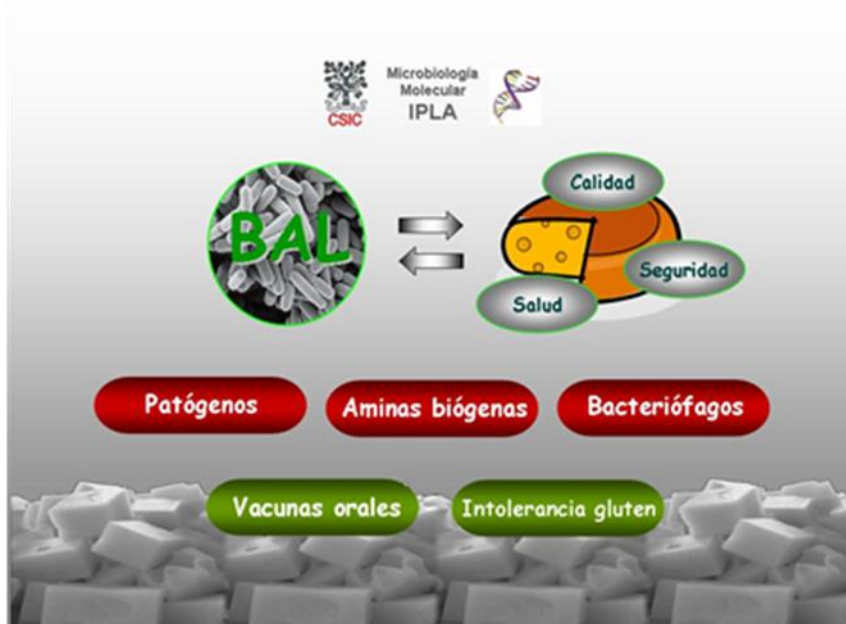




MOLECULAR MICROBIOLOGY

The Molecular Microbiology group of the IPLA-CSIC works on the study of lactic acid bacteria (LAB) and their bacteriophages, with the ultimate goal of contributing to improving the safety and quality of food, as well as consumer health. LAB are an essential microbial group in the Dairy Sector, both for large Industries and for artisan producers, due to their use as starter cultures in the preparation of a wide variety of fermented dairy foods, among which cheeses are worth highlighting. In addition, some strains can produce a beneficial effect on the health of the consumer, where they can help improve the digestibility of some foods, prevent



colonization by pathogens and / or act as immunological adjuvants, so our work focuses not only on their use as starter cultures, but also as probiotics and even as live vectors for the production of therapeutic molecules in the mucosa. However, some LABs are responsible for the accumulation of toxic concentrations of biogenic amines in certain fermented foods and our group is making a great effort to study this problem to develop rational strategies that allow its solution.

Group members:

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Research lines:

1) To ensure the safety of fermented dairy products

- Biogenic amines: Toxicity and strategies to avoid their accumulation in food
- Bacteriophages for the biocontrol of pathogenic and spoilage bacteria.

2) To isolate and develop LAB with new functional properties that allow the development of new products with high added value

- Isolation and characterization of LAB that produce neuroactive compounds.
- Probiotics as live vectors for the production of therapeutic molecules in the mucosa

Recent articles (Last 5 years)

Authors: Beatriz del Rio, Begoña Redruello, D. M. Linares, V. Ladero, M. Fernández, M. C. Martin, P. Ruas-Madiedo and Miguel A. Alvarez

Title: "The dietary biogenic amines tyramine and histamine show synergistic toxicity towards intestinal cells in culture"

Ref: Food Chemistry **218**: 249-255 (2017)

Authors: Begoña Redruello, V. Ladero, B. del Rio, M. Fernández, M. C. Martin and Miguel A. Alvarez

Title: "A UHPLC method for the simultaneous analysis of biogenic amines, amino acids and ammonium ions in beer"

Ref: Food Chemistry **217**: 117-124 (2017)

Authors: Marta Perez, V. Ladero, B. del Rio, B. Redruello, A. de Jong, O. Kuipers, J. Kok, M. C. Martin, M. Fernandez, Miguel A. Alvarez

Title: "The relationship among tyrosine decarboxylase and agmatine deiminase pathways in *Enterococcus faecalis*"

Ref: Frontiers in Microbiology **8**: 2107 (2017)

Authors: Beatriz del Rio, P. Alvarez-Sieiro, B. Redruello, M. C. Martin, M. Fernandez, V. Ladero and Miguel A. Alvarez
Title: “*Lactobacillus rossiae* strain isolated from sourdough produces putrescine from arginine”
Ref: Scientific Reports **8**: 3989 (2018)

Authors: Maria Diaz, Beatriz del Rio, E. Sanchez-Llana, V. Ladero, B. Redruello, M. Fernandez, M. C. Martin, and Miguel A. Alvarez
Title: “*Lactobacillus parabuchneri* produces histamine in refrigerated cheese at a temperature-dependent rate”
Ref: International Journal of Food Science and Technology **53**: 2342-2348 (2018)

Authors: Beatriz del Rio, B. Redruello, D.M. Linares, V. Ladero, P. Ruas-Madiedo, M. Fernández, M. C. Martin and Miguel A. Alvarez
Title: “Spermine and spermidine are cytotoxic towards intestinal cell cultures, but are they a health hazard at concentrations found in foods?”
Ref: Food Chemistry **269**: 321-326 (2018)

Authors: Beatriz del Rio, B. Redruello, V. Ladero, S. Cal, A. Obaya and Miguel A. Alvarez
Title: “An altered gene expression profile in tyramine-exposed intestinal cell cultures supports the genotoxicity of this biogenic amine at dietary concentrations”
Ref: Scientific Reports **8**: 17038 (2018)

Authors: Beatriz del Rio, B. Redruello, D. M. Linares, V. Ladero, P. Ruas-Madiedo, M. Fernandez, M. C. Martin, and Miguel A. Alvarez
Title: “The biogenic amines putrescine and cadaverine show in vitro cytotoxicity at concentrations that can be found in foods”
Ref: Scientific Reports **9**: 120 (2019)

Authors: Beatriz del Rio, B. Redruello, M. Fernandez, M. C. Martin, V. Ladero, and Miguel A. Alvarez
Title: “Lactic Acid Bacteria as a Live Delivery System for the *In Situ* Production of Nanobodies in the Human Gastrointestinal Tract”
Ref: Frontiers in Microbiology **9**: 3179 (2019)

Authors: Beatriz del Rio, E. Sanchez-LLana, B. Redruello, A. H. Magadan, M. Fernandez, M. C Martin, V. Ladero, Miguel A. Alvarez
Title: “*Enterococcus faecalis* bacteriophage 156 is an effective biotechnological tool for reducing the presence of tyramine and putrescine in an experimental cheese model”
Ref: Frontiers in Microbiology **10**: 566 (2019)

Authors: Amanda Moyano, M. Salvador, J. C. Martínez-García, V. Socoliuc, L. Vékás, D. Peddis, Miguel A. Alvarez, M. Fernández, M. Rivas, and M. C. Blanco-López
Title: “Magnetic immunochromatographic test for histamine detection in wine”

Ref: Analytical and Bioanalytical Chemistry **411**: 6615–6624 (2019)

Authors: Marta Perez, M. Calles-Enriquez, B. del Rio, B. Redruello, A. de Jong, O. Kuipers, J. Kok, M. C. Martin, V. Ladero, M. Fernández, and Miguel A. Alvarez

Title: “Construction and characterization of a double mutant of *Enterococcus faecalis* that does not produce biogenic amines”

Ref. revista/libro: Scientific Reports **9**: 16881 (2019)

Authors: Maria Diaz, B. del Rio, V. Ladero, B. Redruello, M. Fernandez, M. C. Martin, and Miguel A. Alvarez

Title: “Histamine production in *Lactobacillus vaginalis* improves cell survival at low pH by counteracting the acidification of the cytosol”

Ref: International Journal of Food Microbiology **321**: 108548 (2020)

Authors: Beatriz del Río, B. Redruello, M. Fernández, V. Ladero y Miguel A. Alvarez.

Title del capítulo: “Aminas biógenas en alimentos: métodos moleculares para la detección e identificación de bacterias productoras”

Ref: Arbor **196** (795): a545 (2020)

Authors: Begoña Redruello, A. Szwengiel, V. Ladero, B. del Rio, and Miguel A. Alvarez

Title: “Identification of technological/metabolic/environmental profiles of cheeses with high GABA contents”

Ref: LWT-Food Science and Technology **130**: 109603 (2020)

Authors: Beatriz del Rio, B. Redruello, M. Fernandez, M. C. Martin, V. Ladero, and Miguel A. Alvarez

Title: “The biogenic amine tryptamine, unlike β -phenylethyamine, shows in vitro cytotoxicity at concentrations that have been found in foods”

Ref: Food Chemistry **331**: 127303 (2020)

Authors: Yasmine Saidi, B. del Rio, D. E. Senouci, B. Redruello, B. Martinez, V. Ladero, M. Kihal and Miguel A. Alvarez

Title: “Polyphasic Characterisation of Non-Starter Lactic Acid Bacteria from Algerian Raw Camel’s Milk and Their Technological Aptitudes”

Ref: Food Technology and Biotechnology **58** (3): 260-272 (2020)

Authors: Beatriz del Rio, E. Sanchez-LLana, N. Martinez, M. Fernandez, V. Ladero, Miguel A. Alvarez

Title: “Isolation and characterization of *Enterococcus faecalis*-infecting bacteriophages from different cheese types”

Ref: Frontiers in Microbiology **11**:592172 (2021)

Authors: E. Renes, D.F. García, D. A. Camino, V. Ladero, Miguel A. Alvarez, M.E. Tornadijo, J. Fresno
Title: “Effect of forage type, season, and ripening time on selected quality properties of sheep milk cheese”
Ref: Journal of Dairy Science **104**: 2539–2552 (2021)

Authors: S. Samperio, D. L Guzmán-Herrador, R. May-Cuz, M. C. Martin, Miguel A Alvarez*, M. Llosa
Title: “Conjugative DNA transfer from *E. coli* to transformation-resistant lactobacilli”
Ref: Frontiers in Microbiology **12**: 606629 (2021)

Authors: Begoña Redruello, Y. Saidi, L. Sampedro, V. Ladero, B. del Rio, Miguel A. Alvarez
Title: “GABA-producing *Lactococcus lactis* strains isolated from camel's milk as starters for the production of GABA-enriched cheese”
Ref: Foods **10**: 633 (2021)

Authors: Begoña Redruello, A. Szwengiel, V. Ladero, B. del Rio, Miguel A. Alvarez
Title: “Are there profiles of cheeses with a high GABA and safe histamine content?”
Ref: Food Control **132**: 108491 (2022)

Recent Projects (Last 5 years)

Title of the project: “Aminas biógenas: toxicidad, factores implicados en su biosíntesis y nuevas estrategias para prevenir su acumulación en alimentos fermentados”.
Financing entity: MINECO
Duration from: 30/12/2016 to: 29/06/2021
PIs: María Fernández y Miguel A. Alvarez

Title of the project: “Promotion of local Mediterranean fermented foods through a better knowledge and management of microbial resources”.
Financing entity: European Union (ERA-NET ARIMNet2)
Duration from: 01/10/2017 to: 30/03/2021
PI: Miguel A. Alvarez

Title of the project: “Ayudas para apoyar la actividad de los grupos de investigación que desarrollen su actividad en el Principado de Asturias”.
Financing entity: Government of the Principality of Asturias
Duration from: 01/01/2018 to: 31/12/2020
PI: Miguel A. Alvarez

Financing entity: “Bacterias del ácido láctico productoras de compuestos neuroactivos”.

Entidad financiadora: MICINN
Duration from: 01/09/2021 to: 31/08/2025
PIs: Victor Ladero y Miguel A. Alvarez

Doctoral Theses

Title: Detection, isolation and characterization of Streptococcus thermophilus bacteriophages in the dairy industry.

PhD candidate: Alfonso Hernández Magadán

University: Oviedo; Faculty: Biology

Date: June 15, 2007

Score: Outstanding "cum laude"

Title: Characterization and regulation of the genes involved in the synthesis of tyramine in lactic acid bacteria

PhD candidate: Daniel Martínez Linares

University: Oviedo; Faculty: Biology

Date: June 29, 2007

Score: Outstanding "cum laude"

Title: Biosynthesis of Biogenic Amines in Lactic Acid Bacteria: Genetic Regulation and Physiological and Technological Implications

PhD candidate: Marina M. Calles Enriques

University: Oviedo; Faculty: Medicine

Date: January 31, 2014

Score: Outstanding "cum laude"

Title: Isolation and development of lactic acid bacteria capable of hydrolyzing the immunotoxic peptides of gluten

PhD candidate: Patricia Alvarez Sieiro

University: Oviedo; Faculty: Medicine

Date: July 9, 2014

Score: Outstanding "cum laude"

Title: Biosynthesis of biogenic amines in human breast milk bacteria: possible physiological implications

PhD candidate: Marta Pérez García

University: Oviedo; Faculty: Medicine

Date: June 17, 2015

Score: Outstanding "cum laude"

Title: Identification and characterization of the bacteria responsible for the accumulation of histamine in cheese

PhD candidate: María Díaz García

University: Oviedo; Faculty: Biology

Date: July 27, 2016

Score: Outstanding "cum laude"

Links to group web pages

<http://www.ipla.csic.es/microbiologia-molecular>

<https://www.ispasturias.es/investigacion/inmunologia-microbiologia-infeccion/microbiologia-molecular/>