Leopoldo Antonio **Naranjo Briceño**

Ph.D. in Molecular Biology & Biotechnology. Fungal Biotech. Applied Mycology. Mycelium Technology. Genetic Engineering of Fungi. CRISPR/Cas Technology.

January, 09th 1969 | Calle Dra. Behm, Vitacura, Santiago, Región Metropolitana. | +56 968 190 496

EXPERIENCE

SPORA, Inc.
Chief Scientific Officer (CSO)
AUGUST 2020 at Present. Huechuraba, Santiago, Chile

- R&D Director of Spora, a LATAM disruptive biotechnology-based platform that seeks to develop a new culturable material using fungal mycelium to self-generate mycelium fabrics.

UNIVERSIDAD REGIONAL AMAZÓNICA Ikiam
Permanent Professor & Researcher
DECEMBER, 2017 to MAY, 2023. Tena, Ecuador

- Permanent Professor & Researcher of the Applied Mycology subject. Also, I will impart microbiology, molecular biology, microbial ecology, enzymes, fermentative processes, and environmental biotechnology subjects. R&D activities were aimed at the development of: (i) Novel fungal mycelium-based biomaterials, (ii) Bioproducts for sustainable agriculture (PGPR, arbuscular mycorrhizal fungi as natural biofertilizers, and fungi as biological control agents of plant diseases), (iii) Edible fungi for sustainable development of the Amazon rainforest, (iv) Oil-polluted soils mycoremediation and extra-heavy crude oil (EHCO) bioconversion processes (EHCO Bioupgrading), (v) Secondary metabolites in Amazon fungi with interesting biological activities (antibacterial, antifungal, and antiviral), (vi) Amphibian's cutaneous microbiome in the fight against Chytridiomycosis global disease, (vii) Designing and developing new tools for genome engineering of filamentous fungi using in vivo and in vitro CRISPR/Cas technology. I was also the Director of the Microbial Biotechnology Laboratory and co-Director of the Applied Microbiology Research Team at IKIAM. Raising more than 200k dollars between 2018-2022 for individual and networking R&D Projects with a high impact on Amazon rainforest conservation.

MYCOWORKS, Inc.
Scientific Advisor
JANUARY to JULY 2020. Berkeley, California, USA

- I was a Scientific Advisor at MycoWorks, a biotechnology company that produces fine leathers from the mycelium of mushrooms for use in luxury fashion, footwear, and beyond. It is backed by some of Silicon Valley's leading venture capital firms.

FUNDACIÓN INSTITUTO DE ESTUDIOS AVANZADOS (IDEA)
Associate Researcher / Director / President
JANUARY 2005 to MAY 2015. Caracas, Venezuela

- Senior Researcher / Head of Petroleum Biotechnology Unit / Director of Energy and Environmental Area. Finally, Dr. Naranjo was promoted to President at IDEA for his academic and scientific merits. Raising more than 9 million dollars between 2006-2015. Dr. Naranjo's research focused on Petroleum Biotechnology and Environmental Biocatalysis (bioconversion of recalcitrant hydrocarbons, EHCO, and PAHs).

EDUCATION

INSTITUTO DE BIOTECNOLOGÍA DE LEÓN (INBIOTEC)
Research Collaborator (Postdoctoral Position)
JUNE 2003 to DECEMBER 2004. Castilla y León, León, Spain

- Genetic and metabolic engineering of filamentous fungi. Biochemical and molecular characterization of biosynthetic pathways of bioactive compounds with interesting pharmacological properties in fungi.

UNIVERSIDAD DE LEÓN (UNILEON)
Ph.D. in Molecular Biology and Biotechnology
SEPTEMBER 1999 – JUNE 2003. Castilla y León, León, Spain

- Ph.D. Candidate working on the European Project "Designing and improving health and food-related production processes using filamentous fungal cell factories." EUROFUNG QLRT-1999-00729. Unión Europea. León. Castilla y León, España. Grant of the AECID Mutis Program.
- 2003 – 2005. Instituto de Biotecnología de León (INBIOTEC). Collaborator Researcher. Postdoctoral Position. Director Dr. Juan Francisco Martín.
- 1999 – 2003. Universidad de León (Spain). Diplomat of Advanced Studies and High-Quality European Doctorate Program in Molecular Biology and Biotechnology (*Summa Cum laude*). Director Dr. Juan Francisco Martín.

UNIVERSIDAD NACIONAL EXPERIMENTAL "FRANCISCO DE MIRANDA" (UNEFM / UCV)
Agronomist Engineering
JANUARY 1993 – DECEMBER 1998. Coro, Edo Falcón, Venezuela

- 1993 – 1998. Universidad Nacional Experimental "Francisco de Miranda" / Universidad Central de Venezuela. Agronomist Engineering (*First place in the Promotion. Honorific and publication mentions*).

SCIENTIFIC PUBLICATIONS

- Molecular detection of the lethal fungus *Batrachochytrium dendrobatidis* (Chytridiomycota) and cultivable skin bacteria associated with three critically endangered species of Atelopus (Anura: Bufonidae) in Ecuador. PeerJ. 2024 Oct 24:12:e18317. doi: 10.7717/peerj.18317
- Field-based molecular detection of *Batrachochytrium dendrobatidis* in critically endangered Atelopus toads and aquatic habitats in Ecuador. PLOS ONE March 14, 2024. https://doi.org/10.1371/journal.pone.0299246
- Nanomaterials in the future biotextile industry: A new cosmovision to obtain smart biotextiles. PERSPECTIVE Article. Front. Nanotechnol., 02 December 2022. Sec. Nanomaterials. Volume 4 - 2022 | ISSN: 2673-3013 https://doi.org/10.3389/fnano.2022.1056498
- *Trametes coccinea* IDEA, un hongo súper productor de lacasas aislado de un lago natural de asfalto: *Tolerancia y biotransformación de hidrocarburos policíclicos aromáticos*. Vol 6, No. 3. BIONATURA. http://revistabionatura.com/files/2021.06.03.7.pdf. DOI. 10.21931/RB/2021.06.03.7
- Bioproductos desarrollados a partir de micelio de hongos: *Una nueva cultura material y su impacto en la transición hacia una economía sostenible* (2021). Vol. 6, No. 1. BIONATURA. DOI. 10.21931/RB/2021.06.01.29

- DNA-based biomonitoring in the tropics: *Detection and control of Batrachochytrium dendrobatidis in Ecuadorian ecosystem*. ARPHA Conference Abstracts 4: e65304. https://doi.org/10.3897/aca.4.e65304
- Amphibian chytridiomycosis, a lethal pandemic disease caused by the killer fungus *Batrachochytrium dendrobatidis*: *New approaches to host defense mechanisms and techniques for detection and monitoring* (2021). Vol. 6, No. 1. BIONATURA. DOI. 10.21931/RB/2021.06.01.28
- Genomic benchmarking studies reveal variations of the polyubiquitination domain of the PSD95 protein in *Homo neanderthalensis* and other primates of the Hominidae family: *Possible implications in the loss of cognitive functions?* (2021) BIONATURA. DOI. 10.21931/RB/2021.06.01.23
- EHCO bioupgrading by fungal biocatalysts. International Symposium on Advances in Hydroprocessing of Oil Fractions (ISAHOF 2019). Proceeding. México City. 9 to 12 de June, 2019.
- Fitotoxicidad de HPA, crudos extra pesados y sus fracciones en Lactuca sativa: *Una interpretación integral utilizando un índice de toxicidad modificado* (2018). Rev. Int. Contam. Ambie. 34 (1) 79-91, 2018 DOI: 10.20937/RICA.2018.34.01.07(1):79-91.
- First evidence of fungal strains isolated and identified from naphtha storage tanks and transporting pipelines in Venezuelan oil facilities (2015). Advances in Microbiology. http://dx.doi.org/10.4236/aim.2015.52014.
- Potential role of oxidative exoenzymes of the extremophilic fungus *Pestalotiopsis palmarum* BM-04 in biotransformation of extra-heavy crude oil (2013). Microbial Biotechnology. DOI: 10.1111/1751-7915.12067.
- Análisis morfológico y localización de las especies bacterianas asociadas a la cianobacteria de interés biotecnológico *Arthrospira* sp., utilizando MEB (2013). Acta Microscópica. Vol. 22, N° 2.
- Morfología del acero al carbono API 5L expuesto a cultivos bacterianos aeróbicos. (2013). Acta Microscópica. Vol. 22, N° 2.
- First evidence of mineralization of petroleum asphaltenes by a strain of Neosartorya fischeri (2011). Microbial Biotechnology. Vol. 4, Issue 5, pages 663–672. DOI: 10.1111/j.1751-7915.2011.00269.
- Biodiversidad y potencial hidrocarbonoclástico de hongos aislados de crudo, sus derivados y suelos contaminados con hidrocarburos: Un meta-análisis. Revista Latinoamericana de Biotecnología Ambiental y Algal (RELBAA). 2012. ISSN: 2007-2570. Vol. 3(1):1-40.
- Bioconversión de crudos extrapesados mediante la utilización de exoenzimas fúngicas. Revista Nuestra América. No. 3. 2012. ISSN: 2244-7555.
- A strategy to obtain axenic cultures of *Arthrospira* spp. (2010). World Journal of Microbiology and Biotechnology. Volume 27, Number 5, 1045-1053. DOI 10.1007/s11274-010-0549-6.
- *Arthrospira platensis* como biofactoría de metabolitos secundarios de interés farmacológico: El ácido Pipecólico. Revista Latinoamericana de Biotecnología Ambiental y Algal (RELBAA). 2010. ISSN: 2007-2570. Vol. 1, No.1.
- Transcriptional up-regulation of four genes of the lysine biosynthetic pathway by homocitrate accumulation in *Penicillium chrysogenum*: homocitrate as a sensor system of the pathway distress (2009). Microbiology. DOI 10.1099/mic.0.031005-0.
- Identificación de biocatalizadores potenciales para la remediación de desechos petrolizados de la Faja Petrolífera del Orinoco. Revista de Estudios Transdisciplinarios (RET). 2009. SSN: 2310-2799. Vol. 1, No. 1.
- Molecular characterization of bacteria isolated from electrical transformer oil (ETO). Potential of *Acinetobacter lwoffii* in ETO-degradation (2008). Bulletin of the M.V. Lomonosov Moscow State University. T.49, No. 2.
- Isolation of autochthonous non-white rot fungi with potential for enzymatic upgrading of Venezuelan extra-heavy crude oil (2007). Biocatalysis and Biotransformation. Vol. 25, 1-9. https://doi.org/10.1080/10242420701379908.
- Characterization of the oat1 gene of *Penicillium chrysogenum* encoding an ω-aminotransferase: Induction by L-lysine, L-ornithine and L-arginine and repression by ammonium (2005). Molecular Genetics and Genomics, 274(3):283-94. DOI: 10.1007/s00438-005-0019-2
- Lysine is catabolized to 2-aminoadipic acid in *Penicillium chrysogenum* by an ω-aminotransferase and to saccharopine by a lysine 2-ketoglutarate reductase. Characterization of the ω-aminotransferase (2005). Molecular Genetics and Genomics, 274(3):272-82. DOI: 10.1007/s00438-005-0018-3
- Expression of cefD2 and the conversion of isopenicillin N into penicillin N by the two-component epimerase system are rate-limiting steps in cephalosporin biosynthesis (2005). Molecular Genetics and Genomics, 272(5): 562–570. DOI: 10.1007/s00438-004-1087-4.
- Inactivation of *lys*7 gene, encoding saccharopine reductase in *Penicillium chrysogenum*, leads to accumulation of the secondary metabolite precursors piperideine-6-carboxylic acid and pipecolic acid from α-aminoadipic acid (2004). Applied and Environmental Microbiology, Vol. 70, No. 2. p. 1031–1039. DOI: 10.1128/AEM.70.2.1031-1039.2004.
- Co-transformation with autonomous replicating and integrative plasmids in *Penicillium chrysogenum* is highly efficient and leads in some cases to rescue of the intact integrative plasmid (2003). Fungal Genetics and Biology, Vol. 40, 83-92. DOI: 10.1016/S1087-1845(03)00081-1.
- The conversion of pipecolic acid into lysine in *Penicillium chrysogenum* requires pipecolate oxidase and saccharopine reductase: Characterization of the *lys*7 gene encoding saccharopine reductase (2001). Journal of Bacteriology, 183(24): 7165-72. DOI: 10.1128/JB.183.24.7165-7172.2001.

BOOKS & BOOK CHAPTERS

- Potential Role of Extremophilic Hydrocarbonoclastic Fungi for Extra Heavy Crude Oil Bioconversion and the Sustainable Development of the Petroleum Industry (2019). Book-chapter. Springer Nature Publishers.
- Plan Estratégico de Ciencia y Tecnología para la Universidad Regional Amazónica Ikiam: Un propuesta (2018). ISBN: 978-9942-8638-9-8
- Fertilización biológica y orgánica del *Agave cocui* (Trelease). *Efecto de la inoculación con hongos micorrízicos arbusculares y la aplicación de abonos orgánicos fermentados sobre la productividad* (2012). Editorial Académica Española (EAE), ISBN: 978-3-659-02619-5.
- El mundo desconocido del ácido pipecólico: *componente y precursor de metabolitos secundarios con importantes actividades biológicas* (2012). Editorial Académica Española (EAE), ISBN: 978-3-8484-6591-0.

PATENTS

- SIDEREAL MYCELIUM FABRICS. International Application No. PCT/US2025/027640 · 03 may. 2025.
- SIDEREAL MYCELIUM FABRICS. U.S. Patent Application No.: 19/197,960 · 02 may. 2025.
- MICOTEXTILES QUE INCLUYEN ANDAMIOS ACTIVADOS Y RETICULANTES DE NANOPARTÍCULAS Y MÉTODOS PARA FABRICARLOS. Patente Aplicación Nº 202403105 (CHILE) · 20 dic. 2024.
- ナノ粒子架橋剤を含むマイコテキスタイルとその作製方法
- 【出願番号】 特願2024-560741 (JAPAN) · 09 dic. 2024
- LARGE-SCALE PRODUCTION OF MYCELIUM-BASED TEXTILES AT MUSHROOM FARM FACILITIES SG Ref: 14867-702.600. International Publication No.: WO 2025/078877 A1 (PCT) · 17 abr. 2025.
- LARGE-SCALE PRODUCTION OF MYCELIUM-BASED TEXTILES AT MUSHROOM FARM FACILITIES. European Patent Application No. 24164252.9 EP 4 538 361 A1 · 16 abr. 2025.
- NANOEMULSIONS FOR INTERNAL HUMECTATION OF MYCELIUM-BASED TEXTILES. USPTO Patent Application No.18/811,742 · 21 ago. 2024
- LARGE-SCALE PRODUCTION OF MYCELIUM-BASED TEXTILES AT MUSHROOM FARM FACILITIES. USPTO Patent Application No. 18/595,392. March 04, 2024.
- MYCOTEXTILES INCLUDING ACTIVATED SCAFFOLDS AND NANO-PARTICLE CROSS-LINKERS AND METHODS OF MAKING THEM. U.S. Patent No. 11,993,068 B2 · 28 may. 2024
- MYCOTEXTILES INCLUDING ACTIVATED SCAFFOLDS AND NANO-PARTICLE CROSS-LINKERS AND METHODS OF MAKING THEM. Canadian Patent Application No. 3248106 (CANADA) · 14 abr. 2023
- MICOTÊXTEIS INCLUINDO SCAFFOLDS ATIVADOS E RETICULANTES DE NANOPARTÍCULA E MÉTODOS DE FABRICAÇÃO DOS MESMOS. IB2023 053847 (BRAZIL) · 14 abr. 2023
- MYCOTEXTILES INCLUDING ACTIVATED SCAFFOLDS AND NANO-PARTICLE CROSS-LINKERS AND METHODS OF MAKING THEM. European Patent Application No. 23168316.0. October 18, 2023.
- MYCOTEXTILES INCLUDING ACTIVATED SCAFFOLDS AND NANO-PARTICLE CROSS-LINKERS AND METHODS OF MAKING THEM. Patent Cooperation Treaty (PCT). October 18, 2023.

- Process for the upgrading of heavy crude oil, extra-heavy crude oil or bitumens through the addition of a biocatalyst. United States Patent Application 20070231870. October 4, 2007.
- Proceso para el mejoramiento de crudos pesados, extrapesados o bitúmenes mediante la adición de un biocatalizador. Patente venezolana. SAPI No. 00661-2006, 31/03/2006.

R+D+I PROJECTS AS PRINCIPAL COORDINATOR (Only 2019 to 2025)

- Sidereal mycotextiles: *new functional materials based on in vivo synthesis of metallic nanoparticles mediated by genetically improved fungi.* CORFO, 2025. Chile.
- Bioconversión de subproductos lignocelulósicos en micoproteínas alternativas de interés nutricional animal ETAPA I. *Caracterización de cepas fúngicas con potencial micoproteico empleando compuestos lignocelulósicos como sustratos*. A project with Arauco company. Abril 2025 at present. Spora, Chile
- Diseño y validación de un micofármaco basado en psilocibina para el tratamiento del dolor crónico y trastornos del ánimo asociados. Spora-USACH. CORFO High Technology. June 2025 at present. Spora, Chile.
- Desarrollo de micofármacos basados en psilocibina para ser utilizados de manera segura como medicina natural en tratamientos psicoterapéuticos alternativos (Spora - ISP). Abril, 2024 at present. Chile.
- Biotechnological strategies focused on bioremediation and recycling of mining tailings. Programa Laboratorio de Innovación en la Minería en los Países Andinos. A project funded by the German Cooperation GIZ in Chile. Ikiam (2021).
- Programmable CRISP19: a one-step all-in-one CRISPR/Cas13a RNP + APX-detection-based platform, preassembled in cell-derived ACE2^{+}, Gigapack Vesicles, for *"tricking, trapping and detecting"* SARS-CoV-2. Leader of one Finalist Team at XPRIZE Rapid COVID-19 Testing Competition (2020-2021).
- BIO-Mask-TTDV: SARS-CoV-2 spike glycoprotein as a key target in the fight against the COVID-2019 pandemic, *"tricking, trapping and detecting the virus"* using a pre-assembled RNP complex Cas13a:sgRNAs:hACE2. MIT COVID-19 CHALLENGE Project. 2020. Leader of one winning Team at MIT COVID-19 Challenge LATIN AMERICA Vs. COVID-19. (June, 2020).
- Economic reactivation of the Arajuno Canton (Amazon Pastaza Province, Ecuador) in Post-COVID-19 Pandemic based on the consolidation of the Traditional Amazonian Chakra Agroproductive System and the creation of local added value and market integration of its products. Leader of a Component. Project funded by German Cooperation GIZ. Ecuador (2020).
- High-throughput sequencing of genomes and metagenomes for the study of new emerging human diseases: *Understanding the COVID-2019 pandemic caused by SARS-CoV-2 in Ecuador*. Ikiam Project (2020).
- Obtaining hydrocarbonoclastic biocatalysts for bioremediation of polluted-soils with recalcitrant crudes in the Ecuadorian Amazon Rainforest. European Project Network IKIAM - Institute of Agrifood Research and Technology (IRTA), GIRO Program. Barcelona, Spain. Project funded by the Agency of International and Development Cooperation (AECID, Spain). 2019-2022.
- Discovering the diversity of native arbuscular mycorrhizal fungi associated with cocoa (*Theobroma cacao*), cedar (*Cedrela montana)* and guayusa (*Ilex guayusa*): *a first step towards obtaining biofertilizers and the sustainable development of agroforestry.* Project funded by CEDIA (Ecuador). 2019-2021.
- First advanced training on Oxford Nanopore DNA sequencing and data analysis: Discovering the amphibian's cutaneous microbiome and killer-chytrid fungi in the Amazon rainforest. The project was funded by the United Nations University's Biotechnology Programme for Latin America and the Caribbean (UNU-BIOLAC). 2020-2021.
- Improving the artisanal production system of edible fungi as a subsistence alternative for the indigenous communities established in the Sumaco Napo-Galeras National Park, Ecuador. Project funded by Ikiam. 2019-2020.

CONGRESS & COURSES WORLDWIDE

- 1995 – 2023. More than 124 scientific communications were presented at national/international congresses worldwide (such as Poster and Oral Communications and magistral Conferences by invitation).
- 1995 – 2020. More than 70 scientific courses were completed.

INTERNATIONAL EXPERIENCE IN R+D+I

- Member of the IndieBio Class 9 Training Program supporting Michroma Start-Up as CRISPR/Cas9 Team leader. San Francisco, CA, USA. Oct-Dec, 2019.
- Liaison Officer at the International Centre for Genetic Engineering and Biotechnology (ICGEB). Trieste, Italia. 2009 to 2020.
- Vice-Gestor and Vocal of the Área de Energía at Programa Iberoamericano CYTED (Ciencia y Tecnología para el Desarrollo). Spain, 2009 to 2012.
- Representante Regional (Venezuela) at Asociación Latinoamericana de Micología (ALMIC). 2008 to 2010.
- He presented his research results in many different modalities, environments and countries, such as Venezuela, Spain, Chile, Cuba, Argentina, Brazil, Mexico, Colombia, Ecuador, the Amazon rainforest, the USA, several European Union countries, Gambia (Africa), Russia, Japan, China, Jordan, and India.

HONORS & AWARDS

- As a Finalist Team in the Open Innovation Track of the XPRIZE RAPID COVID TESTING COMPETITION, I have qualified to enroll in the prestigious XPRIZE Alumni Network. Leader of the Finalist CRISP19 Team with the Proposal: Programmable CRISP19: a one-step all-in-one CRISPR/Cas13a RNP + APX-detection-based platform, preassembled in cell-derived ACE2^{+}, Gigapack Vesicles, for *"tricking, trapping and detecting"* SARS-CoV-2. New York, USA, 2021. As a Finalist Team in the Open Innovation Track of the XPRIZE RAPID COVID TESTING COMPETITION, I have qualified to enroll in the prestigious XPRIZE Alumni Network.
- Leader of the Winning Team of the TRACK-A "Identifying the COVID-19 Immune" with the proposal: "Bio-based masks for *tricking, trapping and detecting* SARS-CoV-2 to fight COVID-19 pandemic". Hackathon of the Massachusetts Institute of Technology COVID-19 CHALLENGE. June 19-21, 2020.
- First Award "Luis Daniel Beauperthuy" in its Honorific Mention. Awarded by the Sociedad Venezolana de Microbiología. Maracaibo, Edo. Zulia, Venezuela. November, 4-6, 2013.
- First Award at the XII Latin American Congress on Organic Geochemistry. XII Latin American Congress on Organic Geochemistry. Santa Marta, Colombia. November, 12-15, 2012. First Award at the Area of Tecnología-Industria en el XV Congreso Venezolano de Microscopía y Microanálisis (CONVEMI). Santa Ana de Coro, Estado Falcón, Venezuela. July, 21-27, 2012.
- Second Award at the Sub-Area of Deterioro de Materiales en el XV Congreso Venezolano de Microscopía y Microanálisis (CONVEMI). Santa Ana de Coro, Estado Falcón, Venezuela. July, 21-27, 2012.
- Third Award at the category de Carteles de Biotecnología Ambiental en el II Congreso de la Sociedad Latinoamericana de Biotecnología Ambiental y Algal (SOLABIAA). Cancún, México. December, 5-9, 2010.
- First Award at the First International Symposium on ENVIRONMENTAL BIOCATALYSIS: *From remediation with enzymes to novel green processes.* Cordoba, España. April, 23-26, 2006.

  MUTIS Program Scholarship. Ministry of Foreign Affairs. Spanish Agency for International Cooperation (AECID). Grant Doctoral Program: University of Leon. León, Spain. October 1999 to March 2003.