

# LATIN AMERICA HUB

PRESENTS the 2nd COLLOQUIUM

**SATURDAY 11th NOVEMBER 2023**

**FREE ONLINE EVENT**

# FROM STARS TO LIFE

<https://bit.ly/3Z5sGuM>



contact

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## 2° NoRCEL's Latin American Hub Colloquium, LAhub 2023, «From Stars to Life»

Astrobiology is a scientific discipline that explores the origins, evolution, distribution, and potential for life in the universe. Astrobiology is then a quest that connects the very fabric of the universe to the delicate threads of life.

The interdisciplinary field that combines principles from astronomy, biology, chemistry, and geology is essential to understand how the fundamental building blocks of life might have formed in space, how they could have been transported to Earth, and how they could potentially develop into more complex organisms, unravelling then the universe's most profound mysteries surrounding the existence of life.

Astrobiology delves into the enigma of existence itself, traversing the vast expanse from stars to the tapestry of life on Earth or on distant planets or moons, making connections between the realms of stars and life itself.

Like cosmic detectives, astrobiologists explore the cosmic highways, investigating collisions and serendipitous encounters that could have ferried life's potential across the interstellar abyss. With eyes aglow with curiosity, they probe the depths of extreme organisms, Earth's own alien landscapes, sketching the genesis of life, tracing the origins, evolution, and potential distribution of living wonders beyond our Earthly cradle, seeking insights into what extreme conditions might have nurtured life on distant planets or moons.



# The NoRCEL TEAM



Martin Dominik. School of Physics & Astronomy, Physics and Astronomy Department at the University of St Andrews, Scotland, UK. President of NoRCEL.



Oleg Kotsyurbenko. Yugra State University, Khanty-Mansiysk, Russia. Vice President of NoRCEL.



Elias Chatzitheodoridis. Mineralogy-Petrology at the National Technical University of Athens (NTUA), Greece. CEO of NoRCEL.



Sohan Jheeta. Founder, Chairman and Editor in Chief of NoRCEL, UK.



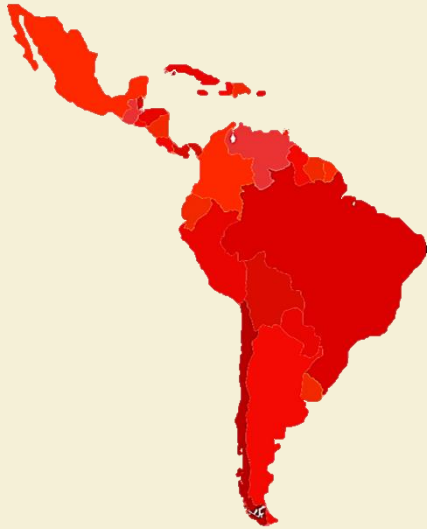
Kathy McGrath, administrator of NoRCEL, UK.



Sávio Torres de Farias. Federal University of Paraiba, Brazil. Vice-president of NoRCEL.



Miryam Palacios-Pérez. National Autonomous University of Mexico, UNAM, Mexico. Head of NoRCEL Latin America Hub and Second Vice-President of NoRCEL.



**We have brought together Argentinian, Cuban, and Mexican scientists who will take us to explore stars, life's origins and habitable worlds, from molecules to tardigrades.**

Please note that hours are provided in Central Mexican Time or CST, which is GMT/UTC –6 (please be sure to check the corresponding time in your location <https://www.worldtimebuddy.com>).

TIME	SPEAKER	LECTURE/ACTIVITY
10:50	NoRCEL	ZOOM opening
11:00-11:28	Miryam Palacios-Pérez & Sohan Jheeta	Presentation of NoRCEL and the Latin America Hub
11:28-11:30		Time cushion/buffer
11:30-11:55	Ximena C. Abrevaya	Stars, life, and planetary habitability
11:55-12:10		Q&A
12:10-12:35	Rolando P. Cárdenas O. & Osmel Martin	On the Potential Origin of Chemoautotrophic Life and Habitability Metrics describing it
12:35-12:50		Q&A
12:50-14:00	LUNCH BREAK	Mealtime
14:00-14:25	Alejandro Heredia-Barbero	Gamma-irradiated glutamic acid under a hydration-dehydration process in a prebiotic Earth scenario: A first infrared spectroscopy approach
14:25-14:40		Q&A
14:40-15:05	Patricia G. Nuñez Pérez	The Tardigrades of Baja California: Ambassadors of Life in Astrobiology
15:05-15:20		Q&A
15:20-15:45	Antígona Segura-Peralta	Habitable worlds
15:45-16:00		Q&A
16:00-16:04	4' free	Stretching the legs / Coffee
16:04-16:12	Everybody with cameras turn on	Gathering "photo"
16:12-16:30	Last commentaries from participants	Last contributions from all speakers and attendees
16:30-16:48	Summing up	Sohan Jheeta and NoRCEL team
16:48-17:00	Thanking	Miryam
17:35	NoRCEL	ZOOM closing



# Lectures at the 2nd NoRCEL Latin American Hub Colloquium 'From Stars to Life'

**Ximena C. Abrevaya**

IAFE (CONICET-UBA), Núcleo Argentino de Investigación en Astrobiología

## **«STARS, LIFE, AND PLANETARY HABITABILITY».**

The concept of habitability allows delimitating which places in the universe could be suitable to sustain life. Planetary habitability in particular can be defined as the “ability of an environment to support the activity of at least one known organism”. As the planetary environment is influenced by the host star the star-planet interaction has to be considered in habitability studies. Stellar activity plays a fundamental role in shaping the planetary conditions and stellar radiation appears as one of the fundamental factors to be studied, as it can be beneficial or detrimental for life through direct or indirect effects. Particularly, UV radiation wavelengths (200-400 nm) can reach the surface of the planet depending on the atmospheric composition and pressure. Very energetic stellar events such as flares and super-flares have been scarcely studied from the biological point of view and are of high relevance since the high UV fluxes that are emitted during these processes could have an impact on life on the surface of a planetary body. Some previous studies in the topic have been using theoretical approaches employing biological data from the literature to determine the of flares and super-flares in the planetary habitability. After an introduction to the topic, in this talk, I am going to show why these theoretical approaches could fail to predict the biological impact of flares and super-flares by contrasting these results with those of obtained by our research group where we employ interdisciplinary approaches by combining astrophysical studies with experimental laboratory approaches. Our efforts are part of the “EXO-UV program” and the “Biosun project” international collaborations between astrophysicists, biologists and geologists that seek to expand the biological impact of radiation environments in planetary bodies by using laboratory simulation experiments.

## **Rolando Pedro Cárdenas & Osmel Martín**

Laboratorio de Ciencia Planetaria;  
Universidad Central “Marta Abreu” de Las Villas; Santa Clara, Villa Clara, Cuba

### ***«ON THE POTENTIAL ORIGIN OF CHEMOAUTOTROPHIC LIFE AND HABITABILITY METRICS DESCRIBING IT».***

Mechanisms leading to homochirality and their potential role in the appearance of chemoautotrophic living beings are discussed, and then a general methodology to build habitability metrics for chemoautotrophy-based ecosystems is outlined.

## **Alejandro Heredia-Barbero**

Laboratorio de Evolución Química, Departamento de Química de Radiaciones y Radioquímica, Instituto de Ciencias Nucleares, UNAM, México

### ***«GAMMA-IRRADIATED GLUTAMIC ACID UNDER A HYDRATION-DEHYDRATION PROCESS IN A PREBIOTIC EARTH SCENARIO: A FIRST INFRARED SPECTROSCOPY APPROACH».***

The study of the origins of life has always been a topic of great interest and intrigue. One possible starting point in this quest is the formation of high molecular weight molecules from amino acids towards the formation of peptides in ancient Earth. Robust evidence supporting this hypothesis lies in the amino acid content found in meteorites. Amino acids are essential for life. In our research at the Laboratory of Chemical Evolution at the Instituto de Ciencias Nucleares, UNAM, we work with organic compounds such as amino acids, tantalizing the possibility that these building blocks of life might have been activated by hydration-dehydration processes and ionizing radiation, paving the way for the formation of more complex molecules to contribute in the formation of the first living systems. Our investigations into how these molecular complexes could have formed through the interaction with gamma and UV radiations and eventually led to the emergence of life on Earth is a relevant topic in our research group. We hope to shed some light on the increase in molecular diversity and structural complexity with these possible prebiotic physicochemical scenarios.

## **Patricia Guadalupe Nuñez Pérez**

Laboratorio de Astrobiología, Instituto de Astronomía, UNAM en Ensenada, Mexico,

### **«THE TARDIGRADES OF BAJA CALIFORNIA: AMBASSADORS OF LIFE IN ASTROBIOLOGY».**

The tardigrade, commonly known as water bears due to their appearance and slow movement, have garnered significant attention in astrobiology in recent years, being recognized as one of the most resilient organisms on Earth. This summary provides an overview of their taxonomic characteristics and their habitat in Baja California, Mexico.

Tardigrades exhibit remarkable survival capabilities, entering a state of cryptobiosis, including anhydrobiosis, quiescence, anoxybiosis, osmobiosis, and cryobiosis, enabling them to endure various extreme environmental conditions (Nelson and Marley, 200). Despite extensive research in Europe, studies on tardigrades in Mexico are relatively scarce. To date, 85 species have been identified in Mexico (Núñez P et al., 2021).

During a research expedition in Sierra San Pedro Martir, we collected mosses and lichen, discovering species belonging to the Eutardigrada and Heterotardigrada class, including *Milnesium* sp., *Macrobiotus* sp., *Paramacrobiotus* sp., *Mesobiotus* sp., *Ramazzottius* sp., and *Echiniscus blumii*. Additionally, our study focused on assessing tardigrades' resistance to radiation and pH variations.

The results obtained offer valuable insights into the adaptability of tardigrades in extreme environments, simulating conditions akin to the acidic atmosphere of Venus and the alkaline soil on Mars, showcasing their potential relevance in future Astrobiological studies.

## **Antígona Segura-Peralta**

Instituto de Ciencias Nucleares, UNAM, México,

### **«HABITABLE WORLDS».**

Astrobiology is the science dedicated to understanding how life emerged on Earth and the possibility that similar processes happen somewhere else in the Universe. One of the goals of this science is to understand what the characteristics of habitable planets are. On this talk I will present the challenges of understanding planetary habitability and the examples of Proxima Centauri b and the planetary system around TRAPPIST-1 that illustrate such challenges.



**Dr. Palacios-Pérez, Coordinator of NoRCEL's Second Latin American Hub Colloquium**  
**Miryam Palacios-Pérez** is a Postdoctoral Researcher Fellow at the Theoretical Biology Group of the National Autonomous University of Mexico, UNAM. She completed her BSc and PhD studies at the same University. Her research, as a first author or in collaborations, has focussed on the early evolution of life by using bioinformatic and theoretical approaches, tracing the evolution of biomolecules following its ancient codes. Miryam became the first Mexican member of the International Team at NoRCEL. Additionally, she has collaborated in other type of works such as structural analyses of SARS-Cov-2 virus, or in microbiome hypotheses.

## **Speakers at the 2nd NoRCEL Latin American Hub Colloquium 'From Stars to Life'**

**We have brought together Argentinian, Cuban, and Mexican scientists who will take us to explore stars, life's origins and habitable worlds, from molecules to tardigrades.**

### **Ximena Celeste Abrevaya, from Argentina.**



Dr. **Ximena Abrevaya** is an Astrobiologist, and Senior Research Scientist (CONICET) at Instituto de Astronomía y Física del Espacio (University of Buenos Aires – CONICET), Argentina. She is the Founding Director of the Argentinian Research Unit in Astrobiology 'AstroBio.ar' ([www.astrobioargentina.org](http://www.astrobioargentina.org)). Dr. Abrevaya obtained her Licenciatura (equivalent to M.Sc.) and Ph.D. degrees in Biological Sciences at the University of Buenos Aires and her doctoral dissertation was the first thesis in Astrobiology in Argentina. Her expertise in Astrobiology relies on interdisciplinary studies where she combines astrophysics, biology, and geology. Her main research topics are related to stellar radiation as a constraint for habitability, for the origin of life in planetary bodies of the Solar System, and for lithopanspermia, as well as halophilic archaea, and radiotolerant microorganisms as models in astrobiology, hypersaline environments as analogues of extraterrestrial environments, and methods for the in situ detection of extraterrestrial life, among others. Since 2019, Abrevaya is an invited scientist at the Institute for Physics, University of Graz, Austria. She is the PI of several international projects, such as "The EXO-UV program", working in collaboration with researchers from multiple institutions in different countries such as Brazil, Austria, the UK, and Germany. Additionally, she has been working in the communication of science for the public for more than 15 years. In 2007 she received the National Award for Science Journalism, given by the Ministry of Science and Technology from Argentina.

## **Rolando Cárdenas & Osmel Martin, from Cuba.**



Prof. Dr. **Rolando Pedro Cardenas Ortiz** received his Ph.D. in Theoretical Physics and a second-degree Doctorate focused in Astrobiology and Earth Sciences. He conducts the multi-interdisciplinary Planetary Science Laboratory at Universidad Central “Marta Abreu” de Las Villas since its foundation in 2011. In the decade of 2000’s, he was recipient of annual awards of the Cuban Academy of Sciences in three occasions for research in Theoretical Cosmology; in 2016, he was the main contributor to that award for works on Astrobiology and Earth Sciences. In 2013, the Cuban Council of State awarded him with Carlos J. Finlay Order, the highest in the country for research activity. In 2016 and 2020, Dr. Cárdenas also received the Honorary Distinction of the Minister of Higher Education for Scientific Research. His research work is in the broad area of mathematical modelling of natural environments at different spatial and temporal scales.



Prof. Dr. **Osmel Martin** received his Ph.D. in Theoretical Physics and conducts research at the Planetary Science Laboratory at Universidad Central “Marta Abreu” de Las Villas since its foundation in 2011. In 2016, he was one of the main contributors for an award of Cuban Academy of Sciences for works on Astrobiology and Earth Sciences. His current research work is in the broad area of mathematical modelling of natural environments, at different spatial-temporal scales, with emphasis in Atmospheric Sciences, BioGeoSciences, Astrobiology, and Physical and Biological Oceanography. Below is a sample of his most recent publications on astrobiology:

Inducing Homochirality Through Intermediary Catalytic Species: A Stochastic Approach. *Astrobiology* (2023).

<https://doi.org/10.1089/ast.2023.0004>

From a coenzyme-like mechanism to homochirality. *Biosystems* (2023)

<https://doi.org/10.1016/j.biosystems.2023.104904>

Darwinian Evolution from a Generational Point of View. *Proceedings of the 3rd International Conference on BioGeoSciences* (2022). [https://doi.org/10.1007/978-3-030-88919-7\\_14](https://doi.org/10.1007/978-3-030-88919-7_14)

The minimal and the optimal size for two different types of encapsulated replicator systems. *Chinese Journal of Physics* (2021). <https://doi.org/10.1016/j.cjph.2021.03.012>

## **Alejandro Heredia-Barbero, from Mexico.**



Prof. Dr. **Alejandro Heredia Barbero** is a biologist from the Faculty of Sciences at the National University of Mexico. In 2006, he obtained the degree of Doctor of Sciences at the same University after having a DAAD doctoral stay from 2003 to 2006 at the Institute of Physics, Westfälische Wilhelms-Universität Münster in Germany in the team of Prof. Dr. Tilman Schaeffer. He carried out postdoctoral stays at Utah State University and at the University of Aveiro in Portugal before working at the Center for Research in Physics (CBPF) in Rio de Janeiro, Brazil. Since 2013, he has worked as a researcher at the Institute of Nuclear Sciences, National Autonomous University of Mexico, where he currently focuses on complex materials and molecular self-ordering and their relevance in molecular evolution in a model of the early Earth. He has about 70 papers, and one of the most relevant ones is about the new physicochemical properties of glycine at the nanoscale in the *Functional Advanced Materials Journal* (Journal IF 19).

**Patricia Guadalupe Nuñez Pérez, from Mexico.**



Prof. Dr. **Guadalupe Nuñez** is originally from Ensenada, Baja California, Mexico. She pursued her undergraduate studies in Biology at the Faculty of Sciences of Universidad Autónoma de Baja California, México, and completed her Ph.D. in Biological Sciences at the University of Granada, Spain. She conducted postdoctoral research at the Department of Geology at CICESE and at the Institute of Engineering at UABC. She also served as the founding director of the Institute of Advanced Studies of Baja California, A.C. Currently, she is a postdoctoral researcher at the Astrobiology Laboratory of the Institute of Astronomy at UNAM in Ensenada. Her areas of expertise encompass Palynology and Astrobiology, and she is an expert in optical and electron microscopy. She has numerous peer-reviewed publications and has presented her work at international conferences. Additionally, she has made significant contributions to science outreach. She co-founded the "Introduction to Astrobiology" course offered at the Faculty of Sciences of UABC since 2004, which has benefited over 600 students. Currently, she is supervising several undergraduate and postgraduate theses and serves as the President of the Mexican Society of Astrobiology (SOMA) A.C. for the term 2022-2024.

**Antígona Segura-Peralta, from Mexico.**



Prof. Dr. **Antígona Segura-Peralta** was a dispersed girl that loved stars and was amazed with all living beings, as a result she became an astrobiologist. She studied a bachelor's degree in Physics, a master in Astronomy and a PhD in Earth Sciences. Antígona was certified in popular communication of science, after one year training at the National Autonomous University of Mexico. She was a postdoctoral researcher in the Penn State Astrobiology Research Center and the Jet Propulsion Laboratory/California where she worked at the Virtual Planetary Laboratory (VPL). Now she is a researcher at the Instituto de Ciencias Nucleares (Nuclear Sciences Institute) at the Universidad Nacional Autónoma de México. She works on planetary habitability, remote detection of life and early conditions of our Solar System.