Lucas de Brito Ayres

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Summary of work experience

Lucas Ayres is a Ph.D. candidate whose work stands at the intersection of Artificial Intelligence, biosensors, and method development aiming to address a wide range of chemical problems. With a strong background in analytical instrumentation and computer science, Lucas brings a unique combined expertise that is an asset to any interdisciplinary team seeking to perform innovative research. Lucas is driven by translating chemical systems from experimental observations (including historical data) into computational methods aiming to unveil new patterns and leverage the discoverability of new Deep Eutectic Solvents and synergistic antioxidant mixtures. His research also focuses on the development of high throughput biosensors and instrumentation deployed for monitoring important bacterial pathogens such as staphylococcus aureus. As a result of those efforts, Lucas co-authored 7 patent applications, two already being licensed.

Educational Background

- **Ph.D. in Chemistry**,
  Clemson University, SC. (01/20 – date)
- **B.S. in Pharmacy Biochemistry**
  University of Sao Paulo, Brazil. (03/14 – 07/19).

Professional Employment History

- **Clemson University, Department of Chemistry**
  Graduate Research Associate (01/20 – date)
- **Clemson University, Department of Chemistry**
  Teaching Assistant (07/20 – 05/22)
- **University of Sao Paulo (Brazil), Department of Chemistry**
  Undergraduate Researcher (04/15 – 07/19)

Awards and Honors

- **Graduate Faculty Award**, Department of Chemistry, Clemson University (2023)
- **Mandel Fellowship**, Department of Chemistry, Clemson University (2020)
- **Honorable Mention**, 26th USP International Symposium of Undergraduate Research, Sao Paulo, Brazil (2018)
- **Honorable Mention**, 25th USP International Symposium of Undergraduate Research, Sao Paulo, Brazil (2017)
- **Honorable Mention**, 24th USP International Symposium of Undergraduate Research, Sao Paulo, Brazil (2016)

Research and Creative Activities

Google Scholar: https://scholar.google.com/citations?user=uJ3TG40AAAAJ&hl=en

Articles in Preparation or Submitted

- **Synergistic Antioxidant Enhancement via BHA/BHT-Based Deep Eutectic Systems**
  Lucas B. Ayres, TE Benavidez, Emmanuel D Dike, and Carlos D. Garcia.
  Journal of Agricultural and Food Chemistry (2024) In preparation
- ***eutXG*: A Gradient Boosting Model to Predict the Melting Point of Deep Eutectic Solvents**
  Lucas B. Ayres, Madushi Bandara, Collin D. McMillen, William T. Pennington, and Carlos D. Garcia.
  Journal of the American Society (2024) In preparation
- **Understanding Antioxidant Synergism via Comprehensive Chemical Analysis and RDKit**
  Lucas B. Ayres, Justin Furgala ,and Carlos D. Garcia
  Food Chemistry (2024) in preparation

- **High-Density Array of Vertical Sensors for High-Throughput Electrochemical Analysis**
  Lucas B. Ayres, Gabriel J. C. Pimentel, Daniel S. Doretto, Júlia A. Poker, Juliana N. Yumi Costa, James C. Pessoa, Ítalo R. S. Bezerra, Maria H. O. Piazzetta, Angelo L. Gobbi, Flávio M. Shimizu, Carlos D. Garcia, Renato S. Lima
  Biosensors and Bioelectronics (2024) – in preparation
- **Ultra-Dense Electrochemical Chips with Arrays of Nanostructured Microelectrodes to Enable Sensitive Diffusion-Limited Bioassays**
  Gabriel J. C. Pimentel, Lucas B. Ayres, Juliana N. Yumi Costa, Waldemir J. Paschoalino Junior, Kristi Whitehead, Lauro T. Kubota, Maria H. O. Piazzetta, Angelo L. Gobbi, Flávio M. Shimizu, Carlos D. Garcia, and Renato S. Lima
  ACS Applied Materials & Interfaces (2024) – revision submitted

Publications in Peer-Reviewed Journals

- **Prediction of NADES Formation Using a Transformer-Based Model.**
  Lucas B. Ayres, Federico Gomez, Jeb Linton, Maria F. Silva and Carlos D. Garcia.
  Scientific Reports 2024 (in press).
- **Single-Response Duplexing of Electrochemical Label-free Biosensor from the Same Tag**.
  Juliana N. Y. Costa, Gabriel J. C. Pimentel, Júlia A. Poker, Leandro Merces, Waldemir J. Paschoalino Junior, Luis C. S. Vieira, Ana C. H. Castro, Wendel A. Alves, Lucas B. Ayres, Lauro T. Kubota, Murilo Santhiago, Carlos D. Garcia, Maria H. O. Piazzetta, Angelo L. Gobbi, Flávio M. Shimizu, Renato S. Lima.
  Adv. Healthcare Materials (2024), Cover article.
- **Predicting Antioxidant Synergism via Artificial Intelligence and Benchtop Data.**
  Lucas B. Ayres, TE Benavidez, Armelle Varillas, Jeb R. Linton DC Whitehead and Carlos D. Garcia.
  Journal of Agricultural and Food Chemistry 71 (2023) 15644–15655, Cover article.
- **Big Data for a Deep problem: Unveiling Natural Deep Eutectic Solvents composition through comprehensive chemical Analysis and RDKIT.**
  Lucas B. Ayres, Grayson, Weavil, and Carlos D. Garcia.
  Journal of Molecular Liquids 389 (2023) 122891
- **Advancements and future directions in cardiac biomarkers detection using lateral flow assays.** Stella Schuster, Mylena Lemes, Lucas Blanes, Lucas Ayres, Carlos D Garcia.
  Analytical Methods 15 (2023) 3610 – 3630
- **Rapid Detection of *Staphylococcus aureus* Using Paper-Derived Electrochemical Biosensors**
  Lucas B. Ayres, Jordan Brooks, Kristi Whitehead, and Carlos D. Garcia.
  Analytical Chemistry 2022, 94, 48, 16847–16854, Cover article.
- **Taking the Leap between Analytical Chemistry and Artificial Intelligence: A Tutorial Review**.
  Lucas B. Ayres, Federico Gomez, Jeb Linton, Maria F. Silva and Carlos D. Garcia.
  Analytica Chimica Acta 1161 (2021) 338403, Cover article.
- **Integrated Instrumental Analysis Teaching Platform with Smartphone-Operated Fluorometer.**
  Lucas B. Ayres, Fernando S. Lopes, Carlos D. Garcia and Ivano G. R. Gutz.
  Analytical Methods 12.(2020) 4109 - 4115 , Cover article.

Book chapters

- **Biosensors in precision medicine. From fundamentals to future trends**.
  Mylena Cunha, Lucas Ayres, Carlos D. Garcia and Lucas Blanes.
  Chapter 7: Recent Advancements in detection and amplification techniques (in press)

Intellectual Property

Provisional Applications

- **Predicting Antioxidant Synergism via Artificial Intelligence**
  Carlos D. Garcia, Lucas Ayres, and Daniel Whitehead
  CURF technology 2023-046 (Filed, 04/13/2023

Filed Applications

- **NADES Formulations comprising pharmaceuticals.**
  Carlos D. Garcia and Lucas Ayres

Application No US18/431,215 (Filed 02/2024)

- **NADES Formulations containing Cannabinoids.**
  Carlos D. Garcia and Lucas Ayres
  Application N^{o} US18/421,523 (Filed 02/2024)
- **System Adapted for the Prediction of NADES Formations.**
  Carlos D. Garcia and Lucas Ayres
  Application No US63/409,549 (Filed, 09/2023)

Presentations in Scientific Meetings (* denotes presenting author)

- **Ultra-Dense Electrochemical Chips with Arrays of Nanostructured Microelectrodes to Enable Sensitive Diffusion-Limited Bioassays**
  Gabriel J. C. Pimentel*, Lucas B. Ayres, Juliana N. Yumi Costa, Waldemir J. Paschoalino Junior, Kristi Whitehead, Lauro T. Kubota, Maria H. O. Piazzetta, Angelo L. Gobbi, Flávio M. Shimizu, Carlos D. Garcia, and Renato S. Lima.
  2023 Congresso de Estudantes do CNPEM (Campinas, Brazil – 12/2023)
- **Paper- Derived Carbon Electrodes, a Versatile Option to Develop Electrochemical Sensors.**
  N. E. Elashkar*, L. B. Ayres, E. Vidal, N. Arroyo and C. D. Garcia
  243rd Electrochemical Society Meeting (Boston, MA - 06/2023)
- **Big Data for a Deep problem: Unveiling Natural Deep Eutectic Solvents composition through comprehensive chemical Analysis and RDKIT.**
  Grayson, Weavil*, Lucas Ayres, and Carlos D. Garcia. 10th Annual Summer Undergraduate Research Symposium, Clemson University (2023).
- **The Dynamic Shift to Green Chemistry: Investigating the Spectral Behavior of Natural Deep Eutectic Solvents (NADES) and their Performance as MALDI-TOF.**
  Grayson Weavil*, Lucas Ayres, Miguel Jose-Bueno, Rakesh Sachideva, and Carlos D. Garcia.
  10th Annual Summer Undergraduate Research Symposium, Clemson University (2023).
- **Teaching chemistry to computers: Exploring the chemical space through text representation.**
  Armelle Varillas*, Lucas B. Ayres, and Carlos D. Garcia.
  National Consortium of Secondary STEM Schools (Chicago, IL – 06/2023)
- **Taking the leap between chemistry and artificial intelligence.**
  Lucas B. Ayres*, and Carlos D. Garcia.
  Spring 2023 Clemson Joint AI Symposium (Clemson, SC – 04/2023)
- **Using Artificial Intelligence to Formulate New Deep Eutectic Solvents.**
  Armelle Varillas*, Lucas B, Ayres, and Carlos D. Garcia.
  South Carolina Junior Academy of Science (Charleston, SC – 03/2023) - Presentation selected for Best Oral Presentation, Computer Science (1st Place)
- **Predicting the Formation of NADES using a Transformer Based Model**.
  Lucas B. Ayres*, Federico Gomez, Jeb Linton, Maria F. Silva and Carlos D. Garcia.
  8th Clemson Chemistry Research Symposium (2023).
- **Toward greener world: A Review of Natural Deep Eutectic Solvents and Therapeutic Deep Eutectic Solvents Properties and Applications.**
  Mays Alhoubani*, Lucas Ayres, and Carlos D Garcia, Garcia.
  8th Clemson Chemistry Research Symposium (2023).
- **Teaching chemistry to computers: Exploring the chemical space through text representation.**
  Armelle Varillas*, Lucas B. Ayres, and Carlos D. Garcia.
  Southeastern Regional Meeting American Chemical Society, Puerto Rico (2022).
- **A Wearable Biosensor to Diagnose *Staphylococcus aureus* Skin Infections**.
  Lucas B. Ayres*, Jordan Brooks, Kristi Whitehead, and Carlos D. Garcia.
  Southeastern Regional Meeting American Chemical Society, Puerto Rico (2022).
- **Teaching chemistry to computers: Exploring the chemical space trough text representation.**
  Lucas B. Ayres*, Armelle Varillas, and Carlos D. Garcia.
  20th Brazilian Meeting on Analytical Chemistry, Brazil (2022).
- **A Wearable Biosensor to Diagnose *Staphylococcus aureus* Skin Infections**.
  Jordan Brooks*, Jordan Brooks, Lucas B. Ayres, Kristi Whitehead, and Carlos D. Garcia.

9th Annual Summer Undergraduate Research Symposium, Clemson University (2022).

- **Using Artificial Intelligence to Formulate New Deep Eutectic Solvents.**
  Armelle Varillas*, Lucas B, Ayres, and Carlos D. Garcia.
  9th Annual Summer Undergraduate Research Symposium, Clemson University (2022).
- **$30 Fluorimeter for Analytical Chemistry.**
  Lucas B. Ayres*, Fernando S. Lopes, Carlos D. Garcia, and Ivano G. R. Gutz.
  6th Clemson Chemistry Research Symposium (2021).
- **Integrated Teaching Tool (ITT): Lab made Low-Cost Instrumentation and Android APP platform forTeaching Instrumental Analytical Chemistry**
  Lucas B. Ayres*, Fernando S. Lopes, IGR Gutz, Claudimir L. Lago.
  26º Simpósio Internacional de Iniciação Científica e Tecnológica da USP (2018).
- **Remote management of analytical instruments by smartphones**.
  Lucas B. Ayres*, FS Lopes, IGR Gutz.
  25º Simpósio Internacional de Iniciação Científica e Tecnológica da USP (2017).
- **Fluorimeter with UV LED source and 3D printed optical block for steady or flow chemical Analysis**.
  Lucas B. Ayres*, FS Lopes, IGR Gutz.
  24º Simpósio Internacional de Iniciação Científica eTecnológica da USP (2016).
- **Avaliacao de dispositivos microcontrolados e impressora 3D para o desenvolbimento de instrumentacao analitica**
  Lucas B. Ayres*, Fernando S. Lopes, and Ivano G. R. Gutz.
  18 º Encontro Nacional de Quimica Analitica, Florianopolis – SC (2016).

Students Mentored

- Justin T. Furgala – Clemson undergrad student (Clemson University, 08/23 – to date)
- Grayson Weavil – REU Student (Clemson University, 05/2023 – 07/2023)
- Armelle Varillas – SPRI Student South Carolina Governor's School for Math and Science, 06/2022 – 07/2022)
- Jordan Brooks – REU Student (Clemson University, 06/2022 – 07/2022

Media Interviews and Articles in Newspapers

- **Rancid food smells and tastes gross – AI tools may help scientists prevent that spoilage.**
  The Conversation (2023)
- **How three Clemson scientists are weaving chemistry research into real-world solutions**.
  Clemson News (2022)

Synergistic activities

- **Associated researcher**.
  Development of low-cost scientific instruments (software and instrumentation) and web platform for astrobiology classes with emphasis on space exploration.
  LUCA EDUCAR, Sao Paulo – Brazil. 2019 - 2022.