



# Daniel Moreira

RESEARCHER

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## Education

### PhD in Biochemistry and Molecular Biology

DEPARTMENT OF CELL BIOLOGY, INSTITUTE OF BIOLOGICAL SCIENCES, UNIVERSITY OF BRASILIA

- Academic degree recognized by the Portuguese Directorate General for Higher Education (DGES)

Brasilia, Brazil

Mar, 2014 - Nov, 2017

### MSc in Biochemistry and Molecular Biology

DEPARTMENT OF CELL BIOLOGY, INSTITUTE OF BIOLOGICAL SCIENCES, UNIVERSITY OF BRASILIA

- Academic degree recognized by the Portuguese Directorate General for Higher Education (DGES)

Brasilia, Brazil

Mar, 2012 - Feb, 2014

### BSc in Biological Sciences

INSTITUTE OF BIOLOGICAL SCIENCES, UNIVERSITY OF BRASILIA

Brasilia, Brazil

Mar, 2008 - Dec, 2011

## Additional Training

### Introduction to Python and Machine Learning for the Biosciences

INSTITUTE FOR RESEARCH & INNOVATION IN HEALTH (I3S), UNIVERSITY OF PORTO

- Basic concepts of machine learning and data science in biosciences with Python.

Porto, Portugal

Oct, 2023

### Advanced Laboratory Animal Science Course (FELASA accredited 020/08F)

INSTITUTE FOR RESEARCH & INNOVATION IN HEALTH (I3S), UNIVERSITY OF PORTO

- Functions A (carrying out procedures on animals), B (designing procedures and projects), and D (killing animals).
- Anesthesia for minor procedures and Anesthesia for surgical procedures.
- Covered species: Mouse, Rat, Zebrafish, and Fish.

Porto, Portugal

May, 2023

### Nanodegree in Programming for Data Science with R

UDACITY, MOUNTAIN VIEW, CA, USA

- SQL fundamentals, R programming fundamentals, and Github version control and sharing.

Online

Apr, 2022

## Research Experience and Appointments

### Molecular and Analytical Medicine Laboratory, Department of Biomedicine, Faculty of Medicine (FMUP), University of Porto

VISITING POSTDOCTORAL FELLOW - BIOSENSING TECHNOLOGIES FOR ADVANCED AND QUANTITATIVE MOLECULAR PROFILING

- Developed an R workflow to automatically extract and analyze data from screen-printed electrodes used as biosensors.
- Developed and employed biosensor-based immunoassays for different sample types (e.g., serum, cerebrospinal fluid) from patients.
- Conducted conventional immunoassays (e.g., ELISA) with clinical samples.

Porto, Portugal

Feb, 2023 - Feb, 2024

### Glial Cell Biology Group, Institute for Research & Innovation in Health (i3S), University of Porto

POSTDOC RESEARCHER WITH EXTERNAL FUNDING - PEP-GLIA - CHARACTERIZATION OF THE MECHANISM OF ACTION OF AN

ANTIOXIDANT PEPTIDE WITH NEUROPROTECTIVE POTENTIAL FROM THE BRAZILIAN BIODIVERSITY

- FRET-based imaging and live-cell imaging.
- Operated motorized inverted epifluorescence microscope (Leica DMI6000 FFW).

Porto, Portugal

Feb, 2023 - Feb, 2024

### Cancer Cell Biology Research Group, Department of Pathology and Experimental Therapeutics, University of Barcelona

VISITING RESEARCHER - DEVELOPMENT OF NEW TECHNOLOGIES TO REDUCE THE INCIDENCE OF GLOBAL DISEASES

- Assessed the cytotoxicity of synthetic peptides towards several cancer cell lines using cell viability assays.

Barcelona, Spain

Mar, 2020 - Apr, 2020

## Department of Cell Biology, Institute of Biological Sciences, University of Brasilia

Brasilia, Brazil

PHD STUDENT - REDOX METABOLISM ADAPTATIONS TO EXTREME ENVIRONMENTS: MECHANISM, DISTRIBUTION AND

Mar, 2014 - Nov, 2017

OCCURRENCE OF THE "PREPARATION FOR OXIDATIVE STRESS" PHENOMENON

- Worked directly in the redefinition of the theory of Preparation for Oxidative Stress.
- Established criteria and mapped (for the first time) the occurrence of Preparation for Oxidative Stress in the animal kingdom.
- Implemented and optimized a method to assess protein glutathionylation.
- Coordinated field expeditions to collect frogs in the Brazilian semi-arid region.

## Department of Cell Biology, Institute of Biological Sciences, University of Brasilia

Brasilia, Brazil

MSC STUDENT - FREE RADICAL METABOLISM DURING DIAPAUSE IN THE SUNFLOWER CATERPILLAR (CHLOSYPNE LACINIA)

Mar, 2012 - Feb, 2014

- Used molecular biology techniques to obtain partial sequences of genes coding antioxidant proteins from a species with no genomic data.
- Insect colony care and maintenance.
- Coordinated field expeditions to collect insects.

## Institute of Biological Sciences, University of Brasilia

Brasilia, Brazil

BS UNDERGRAD - ANTIOXIDANT RESPONSES TO ANOXIA AND REOXYGENATION IN GASTROPODS AND TO BLOOD-FEEDING IN

Mar, 2008 - Dec, 2011

VAMPIRE BATS.

- Applied pharmacological strategies to inhibit antioxidants and investigate their roles in vivo.
- Animal care and maintenance (snails and bats).

# Professional Experience

## Faculty of Medicine, University of Brasilia

Brasilia, Brazil

RESEARCHER IN BIOLOGY

Nov, 2016 - Present

- Designed, executed and supervised a variety of scientific experiments.
- Implemented, optimized and validated HPLC protocols for the analysis of small molecules.
- Responsible for the operation and maintenance of HPLC instruments.
- Delivered training to graduate students in the Medical Sciences Graduate Program.
- Secured grant funding for research and outreach activities.
- Mentored students in undergraduate research projects and co-supervised graduate students.
- Authored +30 peer-reviewed research articles in indexed international scientific journals.
- Invented the RGBradford, a method to measure protein concentrations from pictures taken with a smartphone.
- Member of the organizing/scientific committee of three editions of international scientific meetings on Health Innovation.

## Self Employed

Remote

FREELANCE EDITOR AND WRITER IN THE LIFE SCIENCES

Feb, 2020 - Feb, 2021

- Created visually appealing and technically accurate data visualization elements (figures and tables).
- Wrote passages to ensure clarity and flow in research papers and technical documents.
- Reduced the number of words without loss of content to adhere to guidelines.
- Corrected any error in spelling, grammar and word choice in manuscripts.
- Perfect rating (5 stars out of 5) from clients in the Peerwith platform.

## Cactus Communications

Remote

EDITOR IN THE LIFE SCIENCES (REMOTE CONTRACTOR POSITION)

Dec, 2018 - Jan, 2020

- Strictly adhered to non-disclosure and confidentiality guidelines on confidential information.
- Interacted with clients/authors to ensure that their intended meaning was maintained after editing.
- Edited research manuscripts (60,000 words per month) such that the final text was in standard scientific English, free of unclear or unidiomatic sentences.
- Collaborated with other editors to give and receive feedback on editing jobs.

# Selected Publications

## Glutathione depletion disrupts redox homeostasis in an anoxia-tolerant invertebrate

Antioxidants

FERREIRA-CRAVO, M.; MOREIRA, D.C.; HERMES-LIMA, M.

2023

- First and second authors contributed equally to this work
- 10.3390/antiox12061197

2023

Ferreira-Cravo, M.; Moreira, D.C.; Hermes-Lima, M. Glutathione depletion disrupts redox homeostasis in an anoxia-tolerant invertebrate.

Antioxidants

# Selected Presentations

<b>The Fifth International Congress of Serbian Society for Mitochondrial and Free Radical Physiology</b> PREPARATION FOR OXIDATIVE STRESS: HISTORY, RECENT ADVANCES AND FUTURE DIRECTIONS • Keynote speaker.	Belgrade, Serbia 2024
<b>How Global South Research Can Shape the Future of Comparative Physiology Workshop</b> GALLERIA MELLONELLA AS A MODEL FOR COMPARATIVE BIOCHEMISTRY AND PHYSIOLOGY • Oral presentation.	Kruger National Park, South Africa 2024
<b>10th International Congress of Comparative Physiology and Biochemistry (ICCPB)</b> IS THERE “PREPARATION FOR OXIDATIVE STRESS” IN ESTIVATING FROGS UNDER NATURAL FIELD CONDITIONS OF THE BRAZILIAN SEMI-ARID CAATINGA? • Oral presentation.	Ottawa, Canada 2019
<b>9th International Congress of Comparative Physiology and Biochemistry (ICCPB)</b> REDOX BALANCE, ENDOGENOUS ANTIOXIDANTS AND METABOLIC ADJUSTMENTS DURING TROPICAL DIAPAUSE IN THE SUNFLOWER CATERPILLAR CHLOSZYNE LACINIA (LEPIDOPTERA: NYMPHALIDAE) • Oral presentation.	Kraków, Poland 2015

## Awards and Honors

<b>Inspiration and Resilience Award</b> AWARDEE: DANIEL MOREIRA	The Biochemical Society, UK 2025
<b>Honorable Mention at the 29° Congresso de Iniciação Científica da UnB e 20° Congresso de Iniciação Científica do Distrito Federal</b> AWARDEE: MARIA BEATRIZ NASCIMENTO   SUPERVISOR: DANIEL MOREIRA • Undergrad Research Project Congress	University of Brasilia, Brazil 2023
<b>Best Poster Presentation at the II International Meeting on Innovation in Health</b> PRESENTER: ARIANE NOGUEIRA   CO-AUTHOR: DANIEL MOREIRA	II INOVATEC, Brazil 2020
<b>Best PhD Thesis Great Award in Life Sciences</b> AWARDEE: DANIEL MOREIRA	University of Brasilia, Brazil 2018
<b>Best PhD Thesis Award in Biological Sciences</b> AWARDEE: DANIEL MOREIRA	University of Brasilia, Brazil 2018
<b>Honorable Mention for Poster Presentation at the XXVI Reunião Anual da Federação de Sociedades de Biologia Experimental</b> PRESENTER: DANIEL MOREIRA • Experimental Biology National Meeting	FeSBE Annual Meeting, Brazil 2011
<b>Honorable Mention for Poster Presentation at the at the XVI Congresso de Iniciação Científica da UnB e 7° Congresso de Iniciação Científica do Distrito Federal</b> PRESENTER: DANIEL MOREIRA • Undergrad Research Project Congress	University of Brasilia, Brazil 2010
<b>Best Work in Cell Biology at the XV Congresso de Iniciação Científica da UnB e 6° Congresso de Iniciação Científica do Distrito Federal</b> PRESENTER: DANIEL MOREIRA • Undergrad Research Project Congress	University of Brasilia, Brazil 2009

## Supervision

<b>with</b> WHAT • why	where 2025
<b>with</b> WHAT • why	where 2024

with

WHAT

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2023

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WHAT

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2025	what
2024	what
2023	what
1998	what

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Teaching

Certification, Licenses, and Professional Memberships

The Biochemical Society

MEMBER AND INTERNATIONAL AMBASSADOR

Mar, 2024 - Present

The Society for Experimental Biology (SEB)

MEMBER

Oct, 2023 - Present

Society for Redox Biology and Medicine (SfRBM)

MEMBER

Jul, 2016 - Present

European Peptide Society (EPS)

MEMBER

Jun, 2023 - Present

The International Association for Biological Oceanography (IABO)

MEMBER

Oct, 2022 - Present

Board of Editors in the Life Sciences (BELS)

CERTIFIED EDITOR IN THE LIFE SCIENCES

Nov, 2020

Board of Editors in the Life Sciences (BELS)

MEMBER

Nov, 2020 - Feb, 2023

Regional Council of Biologists (CRBIO, Brazil)

REGISTERED BIOLOGIST

May, 2018 - Present

Funding

Editorial and Peer Review Experience

EDITORIAL BOARD

PeerJ – Life and Environment

ACADEMIC EDITOR

May, 2022 - Present

REVIEWER BOARD

Frontiers in Physiology and Frontiers in Marine Science

REVIEW EDITOR IN AQUATIC PHYSIOLOGY

Apr, 2018 - Present

Frontiers in Physiology

REVIEW EDITOR IN REDOX PHYSIOLOGY

Mar, 2018 - Dec, 2021

Molecules

REVIEWER BOARD MEMBER

Dec, 2020 - Present

SPECIAL ISSUES

## Environmental Influence in Physiological, Endocrine, and Oxidative Stress Responses of Aquatic Invertebrates

Animals

GUEST EDITOR

2024

## Redox Metabolism in Ecophysiology and Evolution, 2nd edition

Antioxidants

GUEST EDITOR

2024

## Redox Metabolism in Ecophysiology and Evolution

Antioxidants

GUEST EDITOR

2022

## Rising Stars in Aquatic Physiology: 2022

Frontiers in Physiology

GUEST ASSOCIATE EDITOR

2022

## Redox Metabolism in Environmental and Ecological Physiology of Animals

Frontiers in Physiology

GUEST ASSOCIATE EDITOR

2022

## The defense responses of aquatic animals to the environment

Frontiers in Physiology

GUEST ASSOCIATE EDITOR

2021

## PEER REVIEW

I have been an active peer reviewer since 2012, building a verified record of >150 reviews for 40 different international indexed journals in the fields of redox biology, biochemistry, biotechnology, molecular biology and comparative physiology. Full peer review record in my Web of Science profile.

## Organizing Committees

## Adhoc Evaluator

## Examination Committee and Academic Degree Jury

## References

## Relevant Research Skills

SOFTWARE

WET LAB TECHNIQUES

## Research Projects

ONGOING

FINALIZED

## Science Popularization, Dissemination and Outreach Activities

## Publications

BOOK CHAPTERS

• **Moreira, D.C.**; Batagin-Neto, A.; Leite, J.R.S.A. (2024). Frog-derived neuroprotective peptides. *Natural Molecules in Neuroprotection and Neurotoxicity*, **1**, 415-436. doi: 10.1016/B978-0-443-23763-8.00018-X

• **Moreira, D.C.**; Paula, D.P.; Hermes-Lima, M. (2012). Redox Metabolism during Tropical Diapause in a Lepidoptera Larva. *Living in a Seasonal World*, **35**, 399-409. doi: 10.1007/978-3-642-28678-0\_35

REFEREED JOURNAL PAPERS

• **Moreira, D.C.**; Hermes-Lima, M. (2024). Dynamics of redox metabolism during complete metamorphosis of insects: Insights from the sunflower caterpillar *Chlosyne lacinia* (Lepidoptera).. *Antioxidants*, **13**, 959. doi: 10.3390/antiox13080959

• **Moreira, D.C.**; Carvalho, D.N.; Santos, E.; Relvas, J.B.; Neves, M.A.D.; Pinto, I.M. (2024). Multi-parametric decision system for analytical performance assessment of electrochemical (bio)sensors. *Advanced Materials Technologies*,

- Giraud-Biloud, M.; **Moreira, D.C.**; Minari, M.; Andreyeva, A.; Campos, E.G.; Carvajalino-Fernández, J.M.; Istomina, A.; Michaelidis, B.; Niu, C.; Niu, Y.; Onde, L.; Prokic, M.; Rivera-Igranham, G.A.; Sahoo, D.; Staikou, A.; Storey, J.M.; Storey, K.B.; Vega, I.A.; Hermes-Lima, M. (2024). Evidence Supporting the 'Preparation for Oxidative Stress' (POS) Strategy in Animals in Their Natural Environment. *Comparative Biochemistry and Physiology A*, **293**, 111626. doi: 10.1016/j.cbpa.2024.111626
- Cancelarich, L.N.; Arrulo, M.; Gugliotti, S.T.; Barbosa, E.A.; **Moreira, D.C.**; Basso N.G.; Pérez, L.O.; de la Torre, B.G.; Albericio, F.; Eaton, P.; Leite, J.R.S.A.; Marani, M.M. (2024). First Bioprospecting Study of Skin Host-Defense Peptides in *Odontophrynus americanus*. *Journal of Natural Products*, **87**, 1714- 1724. doi: 10.1021/acs.jnatprod.4c00184
- Silva, G.R.; Miranda, L.T.G.; Silva, S.A.C.A.; Andrade, L.R.; Souza, N.C.; Sá, B.S.; Santana, E.R.; Vasconcelos, A.G.; **Moreira, D.C.**; Pic-Taylor, A.; Durazzo, A.; Lucarini, M.; Yamaguchi, L.F.; Kato, M.J.; Damazo, A.S.; Arcanjo, D.D.R.; Leite, J.R.S.A.; Baroneza, J.E. (2024). Toxicity and Teratogenic Potential of Piplartine from *Piper tuberculatum* Jacq. during Embryonic Development in Mice (*Mus musculus*). *Drugs and Drug Candidates*, **3**, 353- 367. doi: 10.3390/ddc3020021
- Melo-Fonseca, F.; Gasik, M.; Cruz, A.; **Moreira, D.C.**; Silva, F.S.; Miranda, G.; Pinto, I.M. (2024). Engineering a hybrid Ti6Al4V-based system for responsive and consistent osteogenesis. *ACS Omega*, **9**, 8985- 8994. doi: 10.1021/ac-somega.3c07232
- **Moreira, D.C.**; Zenteno-Savin, T.; Hermes-Lima, M. (2023). Redox Metabolism in Ecophysiology and Evolution. *Antioxidants*, **12**, 1769. doi: 10.3390/antiox12091769
- **Moreira, D.C.** (2023). RGBBradford: Protein quantitation with a smartphone camera. *Journal of Visualized Experiments*, **199**, e65547. doi: 10.3791/65547
- Silva-Carvalho, A.E.; Natiely, N.; Machado, J.V.; **Moreira, D.C.**; Brand, G.D.; Leite, J.R.S.A.; Placido, A.; Eaton, P.; Saldanha-Araujo, F. (2023). The peptide Salamandrin-I modulates components involved in pyroptosis and induces cell death in human leukemia cell line HL-60. *Pharmaceutics*, **15**, 1864. doi: 10.3390/pharmaceutics15071864
- Paula, J.R.; Wang, X.; Xu, C.; **Moreira, D.C.** (2023). Editorial: The defense responses of aquatic animals to the environment. *Frontiers in Physiology*, **14**, 1231014. doi: 10.3389/fphys.2023.1231014
- Ferreira-Cravo, M.; **Moreira, D.C.**; Hermes-Lima, M. (2023). Glutathione depletion disrupts redox homeostasis in an anoxia-tolerant invertebrate. *Antioxidants*, **12**, 1197. doi: 10.3390/antiox12061197. *First and second authors contributed equally to this work*
- **Moreira, D.C.**; Sabino, M.A.C.T.; Minari, M.; Kuzniewski, F.T.B.; Angelini, R.; Hermes-Lima, M. (2023). The Role of Solar Radiation and Tidal Emersion on Oxidative Stress and Glutathione Synthesis in Mussels Exposed to Air. *PeerJ*, **11**, e15345. doi: 10.7717/peerj.15345
- **Moreira, D.C.**; Campos, E.G.; Giraud-Billoud, M.; Storey, K.B.; Hermes-Lima, M. (2023). Commentary: On the Merit of an Early Contributor of the "Preparation for Oxidative Stress" (POS) Theory. *Comparative Biochemistry and Physiology A*, **276**, 111341. doi: 10.1016/j.cbpa.2022.111341
- Farias, J.P.; Barros, A.L.A.N.; De Araujo-Nobre, A.R.; Sobrinho-Junior, E.P.C.; Alves, M.M.D.M.; Carvalho, F.A.D.A.; Da Franca Rodrigues, K.A.; De Andrade, I.M.; Silva-Filho, F.A.E.; **Moreira, D.C.**; Lima, D.F.; Lucarini, M.; Durazzo, A.; Arcanjo, D.D.R.; Leite, J.R.S.A. (2023). Influence of Plant Age on Chemical Composition, Antimicrobial Activity and Cytotoxicity of *Varronia curassavica* Jacq. Essential Oil Produced on an Industrial Scale. *Agriculture*, **13**, 373. doi: 10.3390/agriculture13020373
- Aguilar, S.; Brunetti, A.E.; Garay, A.V.; Santos, L.C.; Perez, L.O.; **Moreira, D.C.**; Cancelarich, N.L.; Barbosa, E.A.; Basso, N.G.; De Freitas, S.M.; Faivovich, J.; Brand, G.; Cabrera, G.M.; Leite, J.R.S.A.; Marani, M.M. (2023). Structure and Function of Cationic Hylin Bioactive Peptides from the Tree Frog *Boana pulchella* in Interaction with Lipid Membranes. *Peptides*, **159**, 170900. doi: 10.1016/j.peptides.2022.170900
- Dematei, A.; Costa, S.R.; **Moreira, D.C.**; Barbosa, E.A.; Friaça Albuquerque, L.F.; Vasconcelos, A.G.; Nascimento, T.; Silva, P.C.; Silva-Carvalho, A.E.; Saldanha-Araujo, F.; Mancini, M.C.S.; Ponte, L.G.S.; Bezerra, R.M.N.; Simabuco, F.M.; Batagin-Neto, A.; Brand, G.; Borges, T.K.S.; Eaton, P.; Leite, J.R.S.A. (2022). Antioxidant and Neuroprotective Effects of the First Tryptophyllin Found in Snake Venom (*Bothrops moojeni*). *Journal of Natural Products*, **85**, 2695- 2705. doi: 10.1021/acs.jnatprod.2c00304

- Gisbert, E.; **Moreira, D.C.**; Mozanadeh, M.T.; Lu, K. (2022). Editorial: Rising Stars in Aquatic Physiology: 2022. *Frontiers in Physiology*, **13**, 1081961. doi: 10.3389/fphys.2022.1081961
- **Moreira, D.C.** (2022). RGBradford: Accurate Measurement of Protein Concentration Using a Smartphone Camera and the Blue to Green Intensity Ratio. *Analytical Biochemistry*, **655**, 114839. doi: 10.1016/j.ab.2022.114839
- **Moreira, D.C.**; Wang, Y.; Lopez-Martinez, G.; Hermes-Lima, M. (2022). Editorial: Redox Metabolism in Environmental and Ecological Physiology of Animals. *Frontiers in Physiology*, **13**, 904746. doi: 10.3389/fphys.2022.904746
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- Santos, B.W.L.; **Moreira, D.C.**; Borges, T.K.D.S.; Caldas, E.D. (2022). Components of *Banisteriopsis caapi*, a Plant Used in the Preparation of the Psychoactive Ayahuasca, Induce Anti-Inflammatory Effects in Microglial Cells. *Molecules*, **27**, 2500. doi: 10.3390/molecules27082500
- De Sousa, N.A.; Marani, M.M.; Lopes, A.L.F.; Silva, E.M.; Barbosa, E.A.; Vasconcelos, A.G.; Kuzniewski, F.T.B.; Lustosa, S.S.; Gomes, K.P.; Colugnati, D.B.; Rocha, J.A.; Santos, L.H.; Benquerer, M.P.; Quelemes, P.; Veras, L.; **Moreira, D.C.**; Gadelha, K.K.L.; Magalhaes, P.J.C.; Placido, A.; Eaton, P.; Nicolau, L.; Medeiros, J.V.R.; Leite, J.R.S.A. (2022). BR-Bombesin: A Novel Bombesin-Related Peptide from the Skin Secretion of the Chaco Tree Frog (*Boana raniceps*) with Physiological Gastric Effects. *Amino Acids*, **54**, 733–747. doi: 10.1007/s00726-021-03114-4
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- Barros, A.L.A.N.; Hamed, A.; Marani, M.; **Moreira, D.C.**; Eaton, P.; Placido, A.; Kato, M.J.; Leite, J.R.S.A. (2022). The Arsenal of Bioactive Molecules in the Skin Secretion of Urodele Amphibians. *Frontiers in Pharmacology*, **12**, 810821. doi: 10.3389/fphar.2021.810821
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- **Moreira, D.C.**; Sabino, M.A.C.T.; Kuzniewski, F.T.B.; Furtado-Filho, O.V.; Carvajalino-Fernandez, J.M.; Angelini, R.; Freire, C.A.; Hermes-Lima, M. (2021). Redox Metabolism in Mussels (*Brachidontes solisianus*) under the Influence of Tides in a Rocky Beach in Southern Brazil. *Estuarine, Coastal and Shelf Science*, **258**, 107424. doi: 10.1016/j.ecss.2021.107424
- **Moreira, D.C.**; Paula, D.P.; Hermes-Lima, M. (2021). Changes in Metabolism and Antioxidant Systems during Tropical Diapause in the Sunflower Caterpillar *Chlosyne lacinia* (Lepidoptera: Nymphalidae). *Insect Biochemistry and Molecular Biology*, **134**, 103581. doi: 10.1016/j.ibmb.2021.103581
- Dematei, A.; Nunes, J.B.; **Moreira, D.C.**; Jesus, J.A.; Laurenti, M.D.; Mengarda, A.C.A.; Vieira, M.S.; Do Amaral, C.P.; Domingues, M.M.; De Moraes, J.; Passero, L.F.D.; Brand, G.; Bessa, L.J.; Wimmer, R.; Kuckelhaus, S.A.S.; Tomas, A.M.; Santos, N.C.; Placido, A.; Eaton, P.; Leite, J.R.S.A. (2021). Mechanistic Insights into the Leishmanicidal and

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## Presentations

### ORAL PRESENTATIONS

#### The Fifth International Congress of Serbian Society for Mitochondrial and Free Radical Physiology

Belgrade, Serbia

PREPARATION FOR OXIDATIVE STRESS: HISTORY, RECENT ADVANCES AND FUTURE DIRECTIONS

2024

#### How Global South Research Can Shape the Future of Comparative Physiology Workshop

Kruger National Park, South Africa

GALLERIA MELLONELLA AS A MODEL FOR COMPARATIVE BIOCHEMISTRY AND PHYSIOLOGY

2024

#### 4th Latin American Biotechnology Symposium

Parnaíba, Brazil

REDOX BIOLOGY AND COVID-19

2022

#### 10th International Congress of Comparative Physiology and Biochemistry (ICCPB)

Ottawa, Canada

IS THERE “PREPARATION FOR OXIDATIVE STRESS” IN ESTIVATING FROGS UNDER NATURAL FIELD CONDITIONS OF THE BRAZILIAN SEMI-ARID CAATINGA?

2019

#### 9th International Congress of Comparative Physiology and Biochemistry (ICCPB)

Kraków, Poland

REDOX BALANCE, ENDOGENOUS ANTIOXIDANTS AND METABOLIC ADJUSTMENTS DURING TROPICAL DIAPAUSE IN THE SUNFLOWER CATERPILLAR CHLOSZYNE LACINIA (LEPIDOPTERA: NYMPHALIDAE)

2015

#### 14th International Hibernation Symposium

Semmering, Austria

REDOX METABOLISM DURING TROPICAL DIAPAUSE IN A LEPIDOPTERA LARVA

2012

#### XXVII Annual Meeting of the Brazilian Federation of Experimental Biology Societies (FeSBE)

Águas de Lindóia, Brazil

OXIDATIVE STRESS MARKERS AND ANTIOXIDANT DEFENSES DURING INSECT DIAPAUSE

2012

### POSTER PRESENTATIONS

#### 38th World Congress of The International Union of Physiological Sciences (IUPS)

Rio de Janeiro, Brazil

MODULATION OF ANTIOXIDANTS AND CENTRAL METABOLISM DURING MONTHS-LONG ESTIVATION OF A FROG IN A SEMI-ARID ENVIRONMENT

2017

<b>VII Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)</b> ADAPTAÇÕES DO METABOLISMO REDOX AOS EXTREMOS AMBIENTAIS: MECANISMO, DISTRIBUIÇÃO E OCORRÊNCIA DO FENÔMENO DE PREPARO PARA O ESTRESSE OXIDATIVO	Brasília, Brazil 2017
<b>VI Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)</b> MODULAÇÃO DE ANTIOXIDANTES E DO METABOLISMO CENTRAL DURANTE MESES DE ESTIVAÇÃO DO ANURO PROCERATOPHRYS CRISTICEPS EM UM AMBIENTE SEMI-ÁRIDO	Brasília, Brazil 2016
<b>V Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)</b> PREPARO PARA O ESTRESSE OXIDATIVO NO REINO ANIMAL	Brasília, Brazil 2015
<b>IV Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)</b> PAPEL DE ANTIOXIDANTES ENDÓGENOS COMO PARTE DO SISTEMA ADAPTATIVO DE UM ANFÍBIO PARA SOBREVIVÊNCIA NAS SECAS DA CAATINGA	Brasília, Brazil 2014
<b>III Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)</b> ASPECTOS BIOQUÍMICOS DA DIAPAUSA DA LAGARTA DO GIRASSOL (CHLOSYPNE LACINIA)	Brasília, Brazil 2013
<b>First International Congress on Oxidative Stress in Aquatic Ecosystems</b> ANIMAL RESPONSES TO WILD FLUCTUATIONS IN OXYGEN AVAILABILITY - REVISITING THE CONCEPT OF 'PREPARATION FOR OXIDATIVE STRESS'	Los Cabos, Mexico 2012
<b>XL Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq)</b> FREE RADICAL METABOLISM DURING DIAPAUSE IN A LEPIDOPTERAN SPECIES	Foz do Iguaçu, Brazil 2011
<b>16º Congresso de Iniciação Científica da Universidade de Brasília e 7º Congresso de Iniciação Científica do Distrito Federal</b> ESTUDO DO SISTEMA ANTIOXIDANTE DURANTE A DIAPAUSA	Brasília, Brazil 2010
<b>15º Congresso de Iniciação Científica da Universidade de Brasília e 6º Congresso de Iniciação Científica do Distrito Federal</b> O PAPEL DA CATALASE NA DEFESA ANTIOXIDANTE DE UM GASTRÓPODE DURANTE UM CICLO DE ANÓXIA E REOXIGENAÇÃO	Brasília, Brazil 2009
<b>XXXVIII Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq)</b> THE ROLE OF CATALASE DURING ANOXIA AND REOXYGENATION IN GASTROPODS	Águas de Lindóia, Brazil 2009

Conference Abstracts

Research Visibility

Appendix X

PHD PROJECT ABSTRACT

## Redox metabolism adaptations to extreme environments: mechanism, distribution and occurrence of the “Preparation for Oxidative Stress” phenomenon.

University of Brasilia, Brazil

MOREIRA, D.C.

when

- Evolution has selected a set of biochemical and physiological adaptations in animals that tolerate wide variations of environmental parameters. Due to its roles in energy metabolism and in reactive oxygen species (ROS) generation, fluctuations in O<sub>2</sub> availability are potentially deleterious to animals. Extreme environments in which oxygen availability and consumption are strongly affected include events of hypoxia, anoxia, freezing, severe dehydration, aerial exposure of aquatic organisms, and estivation. The increase in endogenous antioxidants levels is a common strategy of animals submitted to such situations. This strategy was coined “Preparation for Oxidative Stress” (POS). The aim of this study was: (i) to propose a detailed molecular mechanism for the activation of POS under low oxygen stresses; (ii) to design classification criteria and classify species, determining the prevalence of POS in animals; and (iii) to verify the occurrence of POS in two anurans from the Caatinga during estivation in their natural environment. Published data indicates that POS could be activated by a surge in ROS production during hypoxia. According to this model, the rise in ROS generation would activate redox-sensitive transcription factors (Nrf2, FoxO, HIF-1 e NF-κB), leading to enhanced antioxidant defenses. The proportion of POS-positive species in the animal kingdom depends on the nature of the low oxygen stress. The prevalence of POS-positive species was 54-77%, 64-77% and 75-86% for aerial exposure, anoxia and freezing respectively. In the case of estivation and dehydration the prevalence was higher, reaching 91-100%. For hypoxia, the prevalence of POS-positive animals was 37.5-53%, depending on the criteria. The high prevalence of POS-positive species highlights the important role of antioxidant modulation during low oxygen stresses. Considering that results from field-collected animals might be more ecologically relevant than those from laboratory experiments, we investigated the modulation of antioxidants in the muscle of two anuran species from the Caatinga, *Pleurodema diplolistris* and *Proceratophrys cristiceps*, during estivation without experimental intervention. To do so, we measured the activities of metabolic and antioxidant enzymes, as well as the concentration of reduced and disulfide glutathione. In both species, the activity of citrate synthase decreased by 36% in the muscle of estivating animals collected in the dry season compared to active animals collected in the rainy season. The activities of catalase, glutathione peroxidase (total) and glutathione peroxidase (H<sub>2</sub>O<sub>2</sub>) increased in both species during estivation. In *P. diplolistris*, they increased by 74%, 74% and 73% respectively. While they increased by 48%, 57% and 78% respectively in *P. cristiceps*. Such enhanced antioxidant capacity in both species is the first report of POS occurrence in animals estivating under natural conditions.
- Keywords: antioxidant; ecophysiology; reactive oxygen species; estivation; hypoxia.

## MSC PROJECT ABSTRACT

### Free Radical Metabolism during Diapause in the Sunflower Caterpillar (*Chlosyne lacinia*)

University of Brasilia, Brazil

MOREIRA, D.C.

when

- Animals challenged with adverse environmental conditions rely on metabolic depression as an important adaptive response. Endogenous antioxidant defenses play important roles in different metabolic depression processes (e.g. hypoxia tolerance, freezing, hibernation, estivation and diapause). Among the situations of metabolic depression in which the redox metabolism have been addressed, diapause is one of the least studied, especially in tropical insects. The aim of this work was to identify adaptations of the redox metabolism associated to tropical diapause employing as an animal model the bordered patch *Chlosyne lacinia* caterpillars. The determination of antioxidant and intermediary metabolism enzymes activity and of glutathione and oxidative stress markers concentrations were conducted in whole body homogenates. Animals were collected in three different months, January and March (2010), and June (2011). Experimental groups were active animals (control), diapausing animals for 0-24 hours, 20, 40, 60 and 120 days, and post-diapause active animals. Citrate synthase (CS) activity decreased (70%) at the diapause beginning and returned to control levels at the end of diapause. The activities of the antioxidant enzymes ascorbate peroxidase, catalase and glutathione peroxidase (selenium independent) also decreased by 64%, 51% and 43% respectively at the diapause beginning and returned to control levels at the end of diapause. The activities of glutathione reductase and selenium dependent glutathione peroxidase were not detected in *C. lacinia*. There were significant correlations between antioxidant activities and CS activity. Glucose 6-phosphate dehydrogenase and pyruvate kinase activity remained unchanged in response to diapause. Isocitrate dehydrogenase (NADP<sup>+</sup>) activity increased at diapause beginning and remained higher than control until the 40th day of diapause. Glutathione transferase (GST) activity increased in response to diapause. In the first 24 hours of diapause GST activity increased by 370%. The concentrations of glutathione equivalents (GSH-eq), reduced glutathione (GSH) and oxidized glutathione (GSSG) decreased significantly during diapause and returned to control levels after diapause. Thus, the GSSG/GSH-eq ratio was unaltered. The levels of oxidative stress markers (TBARS and protein carbonyls) either decreased or remained constant during diapause. The results indicate decreased mitochondrial density and reduced aerobic metabolism those were already related during diapause in other species. Potentially diminished production of reactive oxygen species together with mechanisms of reduced energetic demand justify the reduction of endogenous antioxidants. Diapause beginning is accompanied by an increased potential production of NADPH, which could be used by the antioxidant system, by fatty acid synthesis and by polyol synthesis – as dehydration resistance mechanism. Increased GST activity, also observed in other diapausing insects, could play roles other than xenobiotics detoxication, including the binding and transport of biomolecules. The biological function of GST during diapause must be further investigated. The lack of evidences showing oxidative stress or redox imbalance indicates that *C. lacinia* presents efficient biochemical adaptation to survive the metabolic transitions occurring in the tropical diapause under low humidity.
- Keywords: reactive oxygen species; oxidative stress; antioxidants; glutathione; glutathione transferase; metabolic depression; hibernation.

## UNDERGRADUATE RESEARCH PROJECT ABSTRACTS

## The Role of Catalase during Anoxia and Reoxygenation in Gastropods

University of Brasilia, Brazil

WELKER, A.F.; MOREIRA, D.C.; HERMES-LIMA, M.

when

- The importance of each individual antioxidant enzyme for the adaptation of hypoxic tolerant animals to cycles of anoxia and reoxygenation is not well understood. The aim of this work was to assess the role of catalase in land snails *Helix aspersa* during post-anoxic reoxygenation by the suppression of its activity with aminotriazole (ATZ) injection. Catalase activity in foot muscle fell 60% after ATZ administration. ATZ alone resulted in no alterations in the activity of antioxidant enzymes, GSH levels, and oxidative stress markers (OSM): TBARS, carbonyl protein and GSSG:GSH ratio. Anoxia induced a rise in foot Se-GPX activity in saline- and ATZ-injected animals (1.8-2.0 fold). This elevated Se-GPX activity rapidly returned to normal levels at the onset of reoxygenation, whereas this return to normal activity happened 60 min later in ATZ-injected animals. Reoxygenation caused no changes in OSM in foot of saline- or ATZ-injected snails. In hepatopancreas, most parameters remained unchanged in response to ATZ (which suppressed 69% of catalase activity), anoxia or reoxygenation. Anoxia caused a tendency for the increase in Se-GPX activity in both groups ( $p=0.06$  for saline and  $p=0.10$  for ATZ) and only punctual and small increases in carbonyl protein during reoxygenation in ATZ-injected animals. These data show that *Helix aspersa* present an efficient antioxidant system, since oxidative stress was not observed during reoxygenation – even in tissues with catalase suppression. This suggests that activation of Se-GPX activity during anoxia (a process unaffected by ATZ) played a key adaptive role in reoxygenation. The activation of Se-GPX is also encountered in other mollusks during hypoxia/anoxia exposure, which is associated with minor oxidative stress.
- Keywords: antioxidant; metabolism; peroxidation.

## Role of Glutathione during Anoxia and Reoxygenation Stress in Terrestrial Gastropods

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FERREIRA-CRAVO, M.; SABINO, M.A.C.T.; MOREIRA, D.C.; HERMES-LIMA, M.

when

- Previous studies have shown that endogenous antioxidant defenses are relevant for the control of oxidative damage induced by anoxia-plus-reoxygenation stress in terrestrial gastropods (Welker, 2009). One of these defense mechanisms include GSH metabolism. Thus, we decided to investigate oxidative stress in *Helix aspersa* snails during anoxia-plus-reoxygenation after GSH depletion by means of buthionine sulfoximine (BSO) injection – an inhibitor of GSH biosynthesis. Total-GSH (GSH-eq) levels in digestive glands were reduced by 61% in BSO-injected animals. GSSG levels increased by 2-fold in BSO-injected snails during anoxia relative to normoxic snails. GSSG levels were sustained in BSO-injected snails during reoxygenation (15 min to 2 h) despite the partial depletion in GSH-eq. GSSG:GSH-eq ratio also increased (by 2-fold) in anoxia and 15 min-reoxygenation in BSO-injected animals, indicative of a more oxidized state. TBARS and carbonylated proteins were unchanged. Small changes were observed in the activities of antioxidant enzymes (catalase, GST, glutathione reductase and glutathione peroxidase) during anoxia plus reoxygenation in saline- and BSO-injected snails. These activity changes might be related to readjustments of redox metabolism under anoxia/reoxygenation. Thus, partial loss of GSH induces a condition of mild oxidative stress during the phases of oxygen depletion (prior to full anoxia) and reoxygenation. This indicates a relevant role for GSH in the gastropod resistance to anoxia-plus-reoxygenation stress.
- Keywords: anoxia; glutathione; oxidative stress.

## Antioxidant Modulation in Response to Blood-feeding in Vampire Bats

University of Brasilia, Brazil

ANDRADE JR., R.; OLIVEIRA, P.L.; MOREIRA, D.C.; HERMES-LIMA, M.

when

- Unique among mammals, the common vampire bat *Desmodus rotundus* is an obligatory blood feeder and, therefore must handle daily large quantities of ingested hemoglobin-iron. Previous data from our lab indicated that despite its potentially oxidative diet, the vampire bat presents few differences in oxidative status in liver and muscle when compared with rats and mice. In the present work we determinate the effect of a blood meal in the levels of liver and muscle TBARS and carbonyl protein (CP) as well as activities of antioxidant enzyme (Catalase, GST, GR and G6PDH) in vampire bat. We observed an increase in hepatic GST and G6PDH activities after 24h of blood ingestion. A tendency towards an increase in CP levels and towards a mild decrease in TBARS levels was observed in muscle. No changes (over 24h) were found in catalase, GR, CP and TBARS in liver, as well as GST and G6PDH activities in muscle. These results suggest an important role of liver GST and G6PDH to maintain redox status during blood digestion. Biological significance of CP and TBARS levels data in muscle remain unclear. Conceivably, fine regulation of iron metabolism may enable vampire bat to deal with an iron-enriched diet avoiding its availability for oxidative stress induction. Further studies on proteins involved in iron metabolism in gut (where iron intake is controlled) are now under way to confirm this hypothesis.
- Keywords: free radicals; common vampire bat; iron overload.