

Daniel Moreira

RESEARCHER

Faculty of Medicine, University of Brasilia

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I am a researcher and data scientist in the life sciences with 10+ years experience in comparative biochemistry and redox biology.

Education

PhD in Biochemistry and Molecular Biology

Brasilia, Brazil

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

Mar, 2014 - Nov, 2017

- Thesis Title: Redox Metabolism Adaptations to Extreme Environments: Mechanism, Distribution and Occurrence of the “Preparation for Oxidative Stress” Phenomenon
- Academic degree recognized by the Portuguese Directorate General for Higher Education (DGES).

MSc in Biochemistry and Molecular Biology

Brasilia, Brazil

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

Mar, 2012 - Feb, 2014

- Dissertation Title: Free Radical Metabolism during Diapause in the Sunflower Caterpillar (*Chlosyne lacinia*)
- Academic degree recognized by the Portuguese Directorate General for Higher Education (DGES).

BSc in Biological Sciences

Brasilia, Brazil

INSTITUTE OF BIOLOGICAL SCIENCES, UNIVERSITY OF BRASILIA

Mar, 2008 - Dec, 2011

Additional Training

Introduction to Python and Machine Learning for the Biosciences

Porto, Portugal

INSTITUTE FOR RESEARCH & INNOVATION IN HEALTH (i3S), UNIVERSITY OF PORTO

Oct, 2023

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

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

Porto, Portugal

INSTITUTE FOR RESEARCH & INNOVATION IN HEALTH (i3S), UNIVERSITY OF PORTO

May, 2023

- 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.

Nanodegree in Programming for Data Science with R

Online

UDACITY, MOUNTAIN VIEW, CA, USA

Apr, 2022

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

Research Experience and Appointment

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

Porto, Portugal

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

Feb, 2023 - Feb, 2024

- 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.

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

Porto, Portugal

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

ANTIOXIDANT PEPTIDE WITH NEUROPROTECTIVE POTENTIAL FROM THE BRAZILIAN BIODIVERSITY

Feb, 2023 - Feb, 2024

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

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

Barcelona, Spain

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

Mar, 2020 - Apr, 2020

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

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 (CHLOSZYNE 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

COMPARATIVE BIOCHEMISTRY AND REDOX BIOLOGY

- Moreira, D. C.**, Carvajalino-Fernández, J. M., Silva, W. P., Kuzniewski, F., Navas, C. A., De Carvalho, J. E. and Hermes-Lima, M. (2020). Preparation for oxidative stress in *Proceratophrys cristiceps* (Anura, Odontophrynidae) naturally estivating in the Brazilian caatinga. *Science of The Total Environment*, 723, 137957. DOI 10.1016/j.scitotenv.2020.137957.
- Hermes-Lima, M.[¶], **Moreira, D.C.[¶]**, Rivera-Ingraham, G.A., Giraud-Billoud, M., Genaro-Mattos, T.C. and Cam-

pos, E.G. 2015. Preparation for oxidative stress under hypoxia and metabolic depression: Revisiting the proposal two decades later. *Free Radical Biology and Medicine*, 89, 1122–1143. DOI 10.1016/j.freeradbiomed.2015.07.156. [¶]*These authors contributed equally.*

INSECT BIOCHEMISTRY

- **Moreira, D. C.** and Hermes-Lima, M. (2024) Dynamics of redox metabolism during complete metamorphosis of insects: Insights from the sunflower caterpillar *Chlosyne lacinia* (Lepidoptera). *Antioxidants*, 12, 959. DOI 10.3390/antiox13080959.
- **Moreira, D.C.**, Paula, D.P. and 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.

ANALYTICAL CHEMISTRY

- **Moreira, D. C.**, Carvalho, D. N., Santos, E. C., Relvas, J. B., Neves, M. A. D. and Mendes Pinto, I. (2024). Multi-parametric decision system for analytical performance assessment of electrochemical (bio)sensors. *Advanced Materials Technologies*, 9, 2301464. DOI 10.1002/admt.202301464.
- **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

NATURAL PRODUCTS AND BIOTECHNOLOGY

- **Moreira, D. C.**, Batagin-Neto, A. and Leite, J. R. S. A. (2024). Frog-derived peptides and neuroprotection. In *Natural molecules in neuroprotection and neurotoxicity* (pp. 415–436). Elsevier. DOI 10.1016/B978-0-443-23763-8.00018-X.

Selected Conference 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
• Keynote speaker.	
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
• Oral presentation.	
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
• Oral presentation.	
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 *CHLOSYPNE LACINIA* (LEPIDOPTERA: NYMPHALIDAE)	2015
• Oral presentation.	

Awards and Honors

Inspiration and Resilience Award	The Biochemical Society, UK
AWARDEE: DANIEL MOREIRA	2025
Honorable Mention at the 29º Congresso de Iniciação Científica da UnB e 20º Congresso de Iniciação Científica do Distrito Federal	University of Brasilia, Brazil
AWARDEE: MARIA BEATRIZ NASCIMENTO SUPERVISOR: DANIEL MOREIRA	2023
• Undergrad Research Project Congress	
Best Poster Presentation at the II International Meeting on Innovation in Health	II INOVATEC, Brazil
PRESENTER: ARIANE NOGUEIRA CO-AUTHOR: DANIEL MOREIRA	2020

Best PhD Thesis Great Award in Life Sciences <small>AWARDEE: DANIEL MOREIRA</small>	<i>University of Brasilia, Brazil</i> 2018
Best PhD Thesis Award in Biological Sciences <small>AWARDEE: DANIEL MOREIRA</small>	<i>University of Brasilia, Brazil</i> 2018
Honorable Mention for Poster Presentation at the XXVI Reunião Anual da Federação de Sociedades de Biologia Experimental <small>PRESENTER: DANIEL MOREIRA</small> <ul style="list-style-type: none"> Experimental Biology National Meeting 	<i>FeSBE Annual Meeting, Brazil</i> 2011
Honorable Mention for Poster Presentation at the at the XVI Congresso de Iniciação Científica da UnB e 7º Congresso de Iniciação Científica do Distrito Federal <small>PRESENTER: DANIEL MOREIRA</small> <ul style="list-style-type: none"> Undergrad Research Project Congress 	<i>University of Brasilia, Brazil</i> 2010
Best Work in Cell Biology at the XV Congresso de Iniciação Científica da UnB e 6º Congresso de Iniciação Científica do Distrito Federal <small>PRESENTER: DANIEL MOREIRA</small> <ul style="list-style-type: none"> Undergrad Research Project Congress 	<i>University of Brasilia, Brazil</i> 2009

Supervision

Teaching Experience

IS569: Internship (spring 2022). Advised Ankita Khiratkhar (MSIM). • IS589: Independent Study (spring 2022). Advised Chetna Beri (MS). • INFO 399: Individual Study (spring 2022). Advised Leo Zhang (CS undergrad → Currently, Master’s student at UCLA Data Science dept). • IS389: Independent Study (spring 2022). Advised Miso Kim (BSIS). • IS226: Introduction to Human-Computer Interaction (spring 2022). • Served as an annual review committee member for iSchool Ph.d. student Smirity Kaushik (advisor Dr. Yang Wang) (spring 2022). • Served as a field exam committee member for iSchool Ph.D. candidate Jaihyun Park (advisor Dr. Ryan Cordell) (spring 2022).

Certification, Licenses, and Membership

The Biochemical Society <small>MEMBER AND INTERNATIONAL AMBASSADOR</small>	Mar, 2024 - Present
The Society for Experimental Biology (SEB) <small>MEMBER</small>	Oct, 2023 - Present
Society for Redox Biology and Medicine (SfRBM) <small>MEMBER</small>	Jul, 2016 - Present
European Peptide Society (EPS) <small>MEMBER</small>	Jun, 2023 - Present
The International Association for Biological Oceanography (IABO) <small>MEMBER</small>	Oct, 2022 - Present
Board of Editors in the Life Sciences (BELS) <small>CERTIFIED EDITOR IN THE LIFE SCIENCES</small>	Nov, 2020
Board of Editors in the Life Sciences (BELS) <small>MEMBER</small>	Nov, 2020 - Feb, 2023
Regional Council of Biologists (CRBIO, Brazil) <small>REGISTERED BIOLOGIST</small>	May, 2018 - Present

Funding

RESEARCH GRANTS

Biochemical adaptations during metamorphosis: Modulation of antioxidant systems and oxidative stress markers in holometabolous insects

Faculty of Medicine, University of
Brasilia, Brazil
2019 - 2022

PRINCIPAL INVESTIGATOR

- National Council for Scientific and Technological Development (#428048/2018-8)
- Foundation for Research Support of the Federal District (#193.00002154/2018-17)

SCHOLARSHIPS AND FELLOWSHIPS

PEP-GLIA - Characterization of the mechanism of action of an antioxidant peptide with neuroprotective potential from the Brazilian biodiversity

i3S - Institute for Research &
Innovation in Health, Portugal
2023

POST-DOC RESEARCHER - POST-DOCTORAL FELLOWSHIP

- National Council for Scientific and Technological Development - CNPq (#402556/2022-4)

Nutri Tech: Development of Natural Products Aimed at Improving the Quality of Life

Faculty of Medicine, University of
Brasilia, Brazil
2021 - 2022

TECHNICAL COORDINATOR - R & D FELLOWSHIP

- Federal Parliamentary Amendment

Redox metabolism adaptations to extreme environments: mechanism, distribution and occurrence of the 'Preparation for Oxidative Stress' phenomenon

Institute of Biological Sciences,
University of Brasilia, Brazil
2015 - 2017

DOCTORATE STUDENT - SCHOLARSHIP

- Coordination for the Improvement of Higher Education Personnel - CAPES

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

Institute of Biological Sciences,
University of Brasilia, Brazil
2012 - 2014

MASTER STUDENT - MASTERS SCHOLARSHIP

- National Council for Scientific and Technological Development - CNPq

(i) Role of Glutathione during Anoxia and Reoxygenation Stress in Terrestrial Gastropods; (ii) The Role of Catalase during Anoxia and Reoxygenation in Gastropods; (iii) Study of the Antioxidant System during Insect Diapause

Institute of Biological Sciences,
University of Brasilia, Brazil
2008 - 2011

UNDERGRADUATE RESEARCHER - UNDERGRADUATE RESEARCH SCHOLARSHIP

- National Council for Scientific and Technological Development - CNPq

SCIENCE POPULARIZATION, DISSEMINATION AND OUTREACH GRANTS

Human Anatomy Museum at the University of Brasilia - Techniques and Technologies in a University Science Museum

Faculty of Medicine, University of
Brasilia, Brazil
2019

COORDINATOR/PRINCIPAL INVESTIGATOR

- Foundation for Research Support of the Federal District (#193.00001228/2019-89)

Human Anatomy Museum: Science, Art and Inclusion in the National Week of Science and Technology

Faculty of Medicine, University of
Brasilia, Brazil
2018

COORDINATOR/PRINCIPAL INVESTIGATOR

- Foundation for Research Support of the Federal District (#193.00001627/2018-69)

MOBILITY GRANTS AND TRAVEL AWARDS

2024	Travel Grant for the 5th Fifth International Congress of Serbian Society for Mitochondrial and Free Radical Physiology	Belgrade, Serbia
2024	Funded Place in the "How Global South Research Can Shape the Future of Comparative Physiology Workshop"	Kruger National Park, South Africa
2020	Travel Grant for a short-term research mission to Universitat de Barcelona	Barcelona, Spain
2019	Travel Grant for the 10th International Congress of Comparative Physiology and Biochemistry	Ottawa, Canada
2017	Travel Grant for the 38th World Congress of The International Union of Physiological Sciences	Rio de Janeiro, Brazil
2015	Travel Grant for the 9th International Congress of Comparative Physiology and Biochemistry	Krakov, Poland
2012	Travel Grant for the 14th International Hibernation Symposium	Semmering, Austria

Editorial and Peer Review Experience

EDITORIAL BOARD

PeerJ - Life and Environment

ACADEMIC EDITOR

May, 2022 - Present

REVIEWER BOARD

Molecules

REVIEWER BOARD MEMBER

Dec, 2020 - Present

Frontiers in Physiology

REVIEW EDITOR IN REDOX PHYSIOLOGY

Mar, 2018 - Dec, 2021

Frontiers in Physiology and Frontiers in Marine Science

REVIEW EDITOR IN AQUATIC PHYSIOLOGY

Apr, 2018 - Present

SPECIAL ISSUES

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

GUEST EDITOR

Animals

2024

Redox Metabolism in Ecophysiology and Evolution, 2nd edition

GUEST EDITOR

Antioxidants

2024

Redox Metabolism in Ecophysiology and Evolution

GUEST EDITOR

Antioxidants

2022

Rising Stars in Aquatic Physiology: 2022

GUEST ASSOCIATE EDITOR

Frontiers in Physiology

2022

Redox Metabolism in Environmental and Ecological Physiology of Animals

GUEST ASSOCIATE EDITOR

Frontiers in Physiology

2022

The defense responses of aquatic animals to the environment

GUEST ASSOCIATE EDITOR

Frontiers in Physiology

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.

OTHER

Annual Conference of the Society for Redox Biology & Medicine

ABSTRACT REVIEWER

SfRBM

2022

Redox Metabolism in Ecophysiology and Evolution - Special Issue Reprint Book

EDITOR

Antioxidants

2022

Organizing and Scientific Committees _____

Adhoc Consultancy for Funding Agencies _____

Examination Committee and Academic Degree Jury _____

References _____

Research Projects _____

ONGOING

FINALIZED

Full Publication List

BOOK CHAPTERS

1. **Moreira, D. C.**, Batagin-Neto, A., & Leite, J. R. S. A. (2024). Frog-derived peptides and neuroprotection. In *Natural molecules in neuroprotection and neurotoxicity* (pp. 415–436). Elsevier. <https://doi.org/10.1016/B978-0-443-23763-8.00018-X>
2. **Moreira, D. C.**, Paula, D. P., & Hermes-Lima, M. (2012). Redox metabolism during tropical diapause in a lepidoptera larva. In T. Ruf, C. Bieber, W. Arnold, & E. Millesi (Eds.), *Living in a seasonal world* (pp. 399–409). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-28678-0_35

REFEREED JOURNAL PAPERS

1. Cancelarich, N. L., Arrulo, M., Gugliotti, S. T., Barbosa, E. A., **Moreira, D. C.**, Basso, N. G., Pérez, L. O., Teixeira, C., Gomes, P., 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(7), 1714–1724. <https://doi.org/10.1021/acs.jnatprod.4c00184>
2. Giraud-Billoud, M., **Moreira, D. C.**, Minari, M., Andreyeva, A., Campos, É. G., Carvajalino-Fernández, J. M., Istomina, A., Michaelidis, B., Niu, C., Niu, Y., Ondeí, L., Prokić, M., Rivera-Ingraham, G. A., Sahoo, D., Staikou, A., Storey, J. M., Storey, K. B., Vega, I. A., & Hermes-Lima, M. (2024). REVIEW: Evidence supporting the “preparation for oxidative stress” (POS) strategy in animals in their natural environment. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, 293, 111626. <https://doi.org/10.1016/j.cbpa.2024.111626>
3. Melo-Fonseca, F., Gasik, M., Cruz, A., **Moreira, D.**, S. Silva, F., Miranda, G., & Mendes Pinto, I. (2024). Engineering a hybrid Ti6Al4V-based system for responsive and consistent osteogenesis. *ACS Omega*, 9(8), 8985–8994. <https://doi.org/10.1021/acsomega.3c07232>
4. **Moreira, D. C.**, Carvalho, D. N., Santos, E. C., Relvas, J. B., Neves, M. A. D., & Mendes Pinto, I. (2024). Multi-parametric decision system for analytical performance assessment of electrochemical (bio)sensors. *Advanced Materials Technologies*, 9(13), 2301464. <https://doi.org/10.1002/admt.202301464>
5. Silva, G. R., Miranda, L. T. G., Da Silva, S. A. D. C. A., Andrade, L. R. D., Souza, N. C. D., Sá, B. S., Santana, E. R. D., 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. D. S. D. A., & Baroneza, J. E. (2024). Toxicity and teratogenic potential of piparine from *piper tuberculatum* jacq. During embryonic development in mice (*mus musculus*). *Drugs and Drug Candidates*, 3(2), 353–367. <https://doi.org/10.3390/ddc3020021>
6. Aguilar, S., Brunetti, A. E., Garay, A. V., Santos, L. C., Perez, L. O., **Moreira, D.**, 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. <https://doi.org/10.1016/j.peptides.2022.170900>
7. Farias, J. P., Barros, A. L. A. N., De Araújo-Nobre, A. R., Sobrinho-Júnior, 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., & De Souza De Almeida Leite, J. R. (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(2), 373. <https://doi.org/10.3390/agriculture13020373>
8. Ferreira-Cravo, M., **Moreira, D. C.**, & Hermes-Lima, M. (2023). Glutathione depletion disrupts redox homeostasis in an anoxia-tolerant invertebrate. *Antioxidants*, 12(6), 1197. <https://doi.org/10.3390/antiox12061197>
9. **Moreira, D. C.** (2023). RGBradford: Protein quantitation with a smartphone camera. *Journal of Visualized Experiments*, 199, 65547. <https://doi.org/10.3791/65547>
10. **Moreira, D. C.**, Aurélio Da Costa Tavares Sabino, M., Minari, M., Torres Brasil Kuzniewski, F., 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. <https://doi.org/10.7717/peerj.15345>
11. **Moreira, D. C.**, Campos, É. 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 Part A: Molecular & Integrative Physiology*, 276, 111341. <https://doi.org/10.1016/j.cbpa.2022.111341>
12. **Moreira, D. C.**, Zenteno-Savín, T., & Hermes-Lima, M. (2023). Redox metabolism in ecophysiology and evolution. *Antioxidants*, 12(9), 1769. <https://doi.org/10.3390/antiox12091769>
13. 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. <https://doi.org/10.3389/fphys.2023.1231014>
14. Silva-Carvalho, A. É., Oliveira, N. N. D., Machado, J. V. L., **Moreira, D. C.**, Brand, G. D., Leite, J. R. S. A., Plácido, 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(7), 1864. <https://doi.org/10.3390/pharmaceutics15071864>
 15. Barros, A. L. A. N., Hamed, A., Marani, M., **Moreira, D. C.**, Eaton, P., Plácido, 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. <https://doi.org/10.3389/fphar.2021.810821>
 16. 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., Vêras, L., **Moreira, D. C.**, Gadelha, K. K. L., Magalhães, P. J. C., Plácido, A., ... 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(5), 733–747. <https://doi.org/10.1007/s00726-021-03114-4>
 17. 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. É., Saldanha-Araújo, F., Silva Mancini, M. C., Saboia Ponte, L. G., Neves Bezerra, R. M., 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(12), 2695–2705. <https://doi.org/10.1021/acs.jnatprod.2c00304>
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Conference 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

Club on Redox Biology (@clubonredoxbiology on YouTube)

Virtual

PREPARATION FOR OXIDATIVE STRESS IN FROGS FROM THE BRAZILIAN SEMI-ARID REGION DURING ESTIVATION UNDER

NATURAL CONDITIONS

2023

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) REDOX BALANCE, ENDOGENOUS ANTIOXIDANTS AND METABOLIC ADJUSTMENTS DURING TROPICAL DIAPAUSE IN THE SUNFLOWER CATERPILLAR *CHLOSZYNE LACINIA* (LEPIDOPTERA: NYMPHALIDAE)	Kraków, Poland 2015
14th International Hibernation Symposium REDOX METABOLISM DURING TROPICAL DIAPAUSE IN A LEPIDOPTERA LARVA	Semmering, Austria 2012
XXVII Annual Meeting of the Brazilian Federation of Experimental Biology Societies (FeSBE) OXIDATIVE STRESS MARKERS AND ANTIOXIDANT DEFENSES DURING INSECT DIAPAUSE	Águas de Lindóia, Brazil 2012
POSTER PRESENTATIONS	
38th World Congress of The International Union of Physiological Sciences (IUPS) MODULATION OF ANTIOXIDANTS AND CENTRAL METABOLISM DURING MONTHS-LONG ESTIVATION OF A FROG IN A SEMI-ARID ENVIRONMENT	Rio de Janeiro, Brazil 2017
VII Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular) ADAPTAÇÕES DO METABOLISMO REDOX AOS EXTREMOS AMBIENTAIS: MECANISMO, DISTRIBUIÇÃO E OCORRÊNCIA DO FENÔMENO DE PREPARO PARA O ESTRESSE OXIDATIVO	Brasília, Brazil 2017
VI Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular) MODULAÇÃO DE ANTIOXIDANTES E DO METABOLISMO CENTRAL DURANTE MESES DE ESTIVAÇÃO DO ANURO *PRO CERATOPHRYS CRISTICEPS* EM UM AMBIENTE SEMI-ÁRIDO	Brasília, Brazil 2016
V Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular) PREPARO PARA O ESTRESSE OXIDATIVO NO REINO ANIMAL	Brasília, Brazil 2015
IV Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular) PAPEL DE ANTIOXIDANTES ENDÓGENOS COMO PARTE DO SISTEMA ADAPTATIVO DE UM ANFÍBIO PARA SOBREVIVÊNCIA NAS SECAS DA CAATINGA	Brasília, Brazil 2014
III Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular) ASPECTOS BIOQUÍMICOS DA DIAPAUSA DA LAGARTA DO GIRASSOL (*CHLOSZYNE LACINIA*)	Brasília, Brazil 2013
First International Congress on Oxidative Stress in Aquatic Ecosystems ANIMAL RESPONSES TO WILD FLUCTUATIONS IN OXYGEN AVAILABILITY - REVISITING THE CONCEPT OF PREPARATION FOR OXIDATIVE STRESS	Los Cabos, Mexico 2012
XL Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq) FREE RADICAL METABOLISM DURING DIAPAUSE IN A LEPIDOPTERAN SPECIES	Foz do Iguaçu, Brazil 2011
16º Congresso de Iniciação Científica da Universidade de Brasília e 7º Congresso de Iniciação Científica do Distrito Federal ESTUDO DO SISTEMA ANTIOXIDANTE DURANTE A DIAPAUSA	Brasília, Brazil 2010
15º Congresso de Iniciação Científica da Universidade de Brasília e 6º Congresso de Iniciação Científica do Distrito Federal O PAPEL DA CATALASE NA DEFESA ANTIOXIDANTE DE UM GASTRÓPODE DURANTE UM CICLO DE ANÓXIA E REOXIGENAÇÃO	Brasília, Brazil 2009
XXXVIII Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq) THE ROLE OF CATALASE DURING ANOXIA AND REOXYGENATION IN GASTROPODS	Águas de Lindóia, Brazil 2009

Conference Abstracts

Research Visibility and Media Coverage

- SECOM/UnB (university’s communication bureau): “Servidor da UnB recebe prêmio internacional por se destacar na pesquisa científica apesar de dificuldades” (Apr/2024) Available **here**.
- The Biochemical Society: “Biochemical Society announces 2025 award recipients” (Apr/2024) Available **here**.
- Society for Experimental Biology (SEB) Magazine Autumn 2023: “Member News: Club on Redox Biology” (Dec/2023) Available **here**.
- PeerJ Blog: “Author Interview: The role of solar radiation and tidal emersion on oxidative stress and glu-

tathione synthesis in mussels exposed to air” (May/2023) Available **here**.

- DARCY Magazine/SECOM/UnB (university’s communication bureau): “Ciência e tecnologia na palma da mão - Com foto tirada pelo celular, experimento dispensa uso de equipamento sofisticado para medir níveis de proteína de uma amostra” (Apr/2023) Available **here**.
- SECOM/UnB (university’s communication bureau): “Substance produced by amphibian may have application for human health” (Feb/2022) Available **here**.
- Gazeta do Povo: “Life without oxygen” (Jun/2020) Available **here**.
- Gazeta do Povo: “How animals survive without oxygen” (Apr/2019) Available **here**.
- SECOM/UnB (university’s communication bureau): “University of Brasilia awards dissertations and theses” (Nov/2018) Available **here**.
- SECOM/UnB (university’s communication bureau): “Award acknowledges scientific production at the university” (Oct/2018) Available **here**.
- SECOM/UnB (university’s communication bureau): “UnB Science – Oxidative Stress” (Feb/2018) Available **here**.
- SECOM/UnB (university’s communication bureau): “Research classify animals that survive with little or no oxygen”(Apr/2016) Available **here**.
- SECOM/UnB (university’s communication bureau): “Research explains the phenomenon of surviving without oxygen” (Sep/2015) Available **here**.
- Correio Braziliense (local newspaper) “Beyond beauty” (Mar/2014) Printed newspaper March 7th, 2014.
- CorreioWeb (local newspaper): “Common Cerrado butterfly is the solution to the sunflower plague” (Mar/2014) Available **here**.
- SECOM/UnB (university’s communication bureau): “Research investigates the hibernation of butterflies in the Cerrado”(Feb/2014) Available at **here**.
- SECOM/UnB (university’s communication bureau): “Research explains mechanisms against free radical damage” (May/2013) Available **here**.

Appendix - Research Skills

METHODS

- Animal Care (snails and insect colonies maintenance)
- Animal Euthanasia (rats, mice, bats, frogs, snails and insects)
- Animal Field Collection (bats, frogs and insects)
- Bacterial Transformation
- Basic Cell Culture
- cDNA Synthesis
- Cell Viability Assays (MTT, neutral red, and luminescent assays)
- Enzyme-linked immunosorbent assay (ELISA)
- Enzymatic Activity Assays (especially metabolic, antioxidant, and detoxification enzymes)
- Glutathione (reduced and disulfide) Measurement
- Electrophoretic mobility shift assays (EMSA)
- Immunoblot (western blotting)
- In vitro colorimetric and fluorometric antioxidant assays (e.g., DPPH, ABTS, ORAC, etc.)
- Lactate Measurement
- Nucleic Acid Electrophoresis and Band Extraction
- Oxidative Stress Markers Measurement (e.g., TBARS, lipid hydroperoxides, and protein carbonyls)
- PCR
- Plasmid DNA Purification (“Miniprep”)
- Primer Design
- Protein Electrophoresis and Gel Staining
- Quantitative HPLC Method Development and Analysis

- Protein, RNA, and DNA Extraction
- Synthetic Peptide Purification (HPLC)

EQUIPMENT

- HPLC systems – analytical and semi-preparative setups (e.g., Shimadzu Modular HPLC)
- Microplate readers – end-point, kinetic, absorbance, and fluorescence assays (e.g., SpectraMax M3, iD3 etc.)
- Oxygraph (e.g., Hansatech Oxygraph Plus System)
- Screen Printed Electrode Potentiostat
- Basic laboratory equipment, such as analytical balance; autoclave; centrifuge; fume hood; incubator; laminar flow hood; micropipette; optical microscope; nanodrop; pHmeter; protein and nucleic acids electrophoresis apparatus; spectrophotometer; vacuum concentrator; water distiller and purification systems; western blotting apparatus.

SOFTWARE

- GraphPad Prism (GraphPad Software)
- LabSolutions (Shimadzu)
- SoftMax Pro (Molecular Devices)
- OxyTrace+ (Hansatech)
- MultiTrace (Palmsense)
- R Studio (Posit)

Appendix - Courses Attended

R for Biochemists 201

BIOCHEMICAL SOCIETY, LONDON, UK

- Tidy data techniques, advanced visualizations, statistics and using R Markdown.

Online

Aug, 2024

R for Biochemists 101

BIOCHEMICAL SOCIETY, LONDON, UK

- R programming skills for data manipulation and visualization using biochemical data.

Online

Mar, 2024

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

Medical Immunology

UNIVERSITY OF BRASILIA

- Innate immunity, lymphocyte formation, antibodies, immune responses, cytokines, immunization, and autoimmune diseases.
- 80-hour course

Brasilia, Brazil

Nov, 2021

Writing in the Sciences

STANFORD UNIVERSITY ON COURSERA

Online

Oct, 2019

Use and Management of Laboratory Animals

UNIVERSITY OF SAO PAULO

- 60-hour course

Online

Feb, 2019

Basic Operation and Maintenance of HPLC Systems

SHIMADZU

Brasilia, Brazil

Apr, 2017

International Course on Comparative Physiology of Respiration

SAO PAULO STATE UNIVERSITY

Jaboticabal, Brazil

Jul, 2015

Chemical Ecology in Agriculture

BRAZILIAN AGRICULTURAL RESEARCH CORPORATION

Brasília, Brazil

Jul, 2013

Fundamentals of Pharmacology

UNIVERSITY OF PENNSYLVANIA ON COURSERA

Online

Jul, 2013

- Pharmacokinetics, pharmacodynamics and the drug development process.

Genes and the Human Condition (From Behavior to Biotechnology)

UNIVERSITY OF MARYLAND, COLLEGE PARK ON COURSERA

Online

Jun, 2013

Oxygen and Redox Processes

BRAZILIAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY

Foz do Iguaçu, Brazil

May, 2010

Herpetology

GOIAS STATE UNIVERSITY

Anápolis, Brazil

Aug, 2007

Microsoft Network Administrator

NATIONAL SERVICE FOR COMMERCIAL LEARNING

Brasília, Brazil

Dec, 2006

- 110-hour course

Assembly, Maintenance, and Configuration of Computers

NATIONAL SERVICE FOR COMMERCIAL LEARNING

Brasília, Brazil

Sep, 2006

- 90-hour course

Appendix - Undergrad and Graduate Projects

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 O₂ 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 dipolistris* 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 (H₂O₂) increased in both species during estivation. In *P. dipolistris*, 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

- 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+) 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

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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

University of Brasilia, Brazil

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.

- 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.