



# Daniel Moreira

RESEARCHER

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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

## 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

OCCURRENCE OF THE "PREPARATION FOR OXIDATIVE STRESS" PHENOMENON

Mar, 2014 - Nov, 2017

- 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 VAMPIRE BATS.

Mar, 2008 - Dec, 2011

- 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 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

2019

SEMI-ARID CAATINGA?

- 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

2015

SUNFLOWER CATERPILLAR \*CHLOSYNE LACINIA\* (LEPIDOPTERA: NYMPHALIDAE)

- Oral presentation.

## Awards and Honors

Inspiration and Resilience Award

AWARDEE: DANIEL MOREIRA

The Biochemical Society, UK

2025

Honorable Mention at the 29° Congresso de Iniciação Científica da UnB e 20° Congresso de Iniciação Científica do Distrito Federal

AWARDEE: MARIA BEATRIZ NASCIMENTO | SUPERVISOR: DANIEL MOREIRA

University of Brasilia, Brazil

2023

- Undergrad Research Project Congress

Best Poster Presentation at the II International Meeting on Innovation in Health

PRESENTER: ARIANE NOGUEIRA | CO-AUTHOR: DANIEL MOREIRA

II INOVATEC, Brazil

2020

Best PhD Thesis Great Award in Life Sciences

AWARDEE: DANIEL MOREIRA

University of Brasilia, Brazil

2018

Best PhD Thesis Award in Biological Sciences

AWARDEE: DANIEL MOREIRA

University of Brasilia, Brazil

2018

Honorable Mention for Poster Presentation at the XXVI Reunião Anual da Federação de Sociedades de Biologia Experimental

PRESENTER: DANIEL MOREIRA

FeSBE Annual Meeting, Brazil

2011

- Experimental Biology National Meeting

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

PRESENTER: DANIEL MOREIRA

University of Brasilia, Brazil

2010

- Undergrad Research Project Congress

Best Work in Cell Biology at the XV Congresso de Iniciação Científica da UnB e 6° Congresso de Iniciação Científica do Distrito Federal

PRESENTER: DANIEL MOREIRA

University of Brasilia, Brazil

2009

- Undergrad Research Project Congress

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

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

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## Editorial and Peer Review Experience

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### 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

GUEST EDITOR

2024

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

GUEST EDITOR

2024

#### Redox Metabolism in Ecophysiology and Evolution

GUEST EDITOR

2022

#### The defense responses of aquatic animals to the environment

GUEST ASSOCIATE EDITOR

2021

#### Rising Stars in Aquatic Physiology: 2022

GUEST ASSOCIATE EDITOR

2022

#### Redox Metabolism in Environmental and Ecological Physiology of Animals

GUEST ASSOCIATE EDITOR

2022

### 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 and Scientific Committees

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## Adhoc Consultancy for Funding Agencies

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## Examination Committee and Academic Degree Jury

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## References

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## Relevant Research Skills

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### SOFTWARE

## Research Projects

ONGOING

FINALIZED

## Science Popularization, Dissemination and Outreach Activities

## 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)

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

#### VII Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)

Brasília, Brazil

ADAPTAÇÕES DO METABOLISMO REDOX AOS EXTREMOS AMBIENTAIS: MECANISMO, DISTRIBUIÇÃO E OCORRÊNCIA DO FENÔMENO DE PREPARO PARA O ESTRESSE OXIDATIVO

2017

#### VI Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)

Brasília, Brazil

MODULAÇÃO DE ANTIOXIDANTES E DO METABOLISMO CENTRAL DURANTE MESES DE ESTIVAÇÃO DO ANURO \*PROCRATOPHRYS CRISTICEPS\* EM UM AMBIENTE SEMI-ÁRIDO

2016

#### V Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)

Brasília, Brazil

PREPARO PARA O ESTRESSE OXIDATIVO NO REINO ANIMAL

2015

#### IV Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)

Brasília, Brazil

PAPEL DE ANTIOXIDANTES ENDÓGENOS COMO PARTE DO SISTEMA ADAPTATIVO DE UM ANFÍBIO PARA SOBREVIVÊNCIA NAS SECAS DA CAATINGA

2014

#### III Simpósio do Programa de Pós-Graduação em Ciências Biológicas (Biologia Molecular)

Brasília, Brazil

ASPECTOS BIOQUÍMICOS DA DIAPAUSA DA LAGARTA DO GIRASSOL (\*CHLOSZYNE LACINIA\*)

2013

## First International Congress on Oxidative Stress in Aquatic Ecosystems

Los Cabos, Mexico

ANIMAL RESPONSES TO WILD FLUCTUATIONS IN OXYGEN AVAILABILITY - REVISITING THE CONCEPT OF PREPARATION FOR  
OXIDATIVE STRESS

2012

## XL Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq)

Foz do Iguaçu, Brazil

FREE RADICAL METABOLISM DURING DIAPAUSE IN A LEPIDOPTERAN SPECIES

2011

## 16º Congresso de Iniciação Científica da Universidade de Brasília e 7º Congresso de Iniciação Científica do Distrito Federal

Brasília, Brazil

ESTUDO DO SISTEMA ANTIOXIDANTE DURANTE A DIAPAUSA

2010

## 15º Congresso de Iniciação Científica da Universidade de Brasília e 6º Congresso de Iniciação Científica do Distrito Federal

Brasília, Brazil

O PAPEL DA CATALASE NA DEFESA ANTIOXIDANTE DE UM GASTRÓPODE DURANTE UM CICLO DE ANÓXIA E REOXIGENAÇÃO

2009

## XXXVIII Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology (SBBq)

Águas de Lindóia, Brazil

THE ROLE OF CATALASE DURING ANOXIA AND REOXYGENATION IN GASTROPODS

2009

## Conference Abstracts

## Research Visibility

## Appendix A

### 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

- 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

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

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.