

Curriculum vitæ

Nuno Miguel Formiga Borges

October '12

1. Personal Data

Name: Nuno Miguel Formiga Borges

Nationality: Portuguese

Working Address:

Instituto de Tecnologia Química e Biológica (www.itqb.unl.pt)

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2. Academic Degrees and Education

1998 | Biochemistry Degree

Faculdade de Ciências, Universidade de Lisboa

Final Classification: 16/20

Lisbon, November, 19

2004 | Ph.D. in Biochemistry

“The Role of Mannosylglycerate in Thermo- and Osmo-Adaptation of *Rhodothermus marinus*: Biosynthesis, Regulation and Applications”

Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa.

Classification: Approved by unanimity

Oeiras, July, 9

Supervised: Prof. Helena Santos

Examined: Prof. Volker Müller, Prof. José Berenguer de Carlos, Prof. Milton Simões da Costa, Prof. Pedro Moradas-Ferreira, Prof. Adriano Henriques, and Prof. Margarida Amaral.

Post graduation courses

1999 | Cellular Biotechnology Course

Course inscribed in the Ph.D. program of Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa.

6-18, October, Oeiras, Portugal.

2004 | Proteomics Master Class, A training course on 2D Gel Electrophoresis

Course lectured by Anne Hesseling-Meinders (Groningen Biomolecular Sciences and Biotechnology Institute, the Netherlands) at Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa.

14-25, June, Oeiras, Portugal.

3. **Scientific Activities**

1997|1998: *Undergraduate Student (PRODEP fellowship)* at **Instituto de Tecnologia Química e Biológica (Universidade Nova de Lisboa, UNL)**

Training year of the Biochemistry degree with the work entitled "**Estudo do Efeito Termo-Estabilizador de Manosilglicerato em Enzimas-Modelo e Re-avaliação da Identificação de Solutos Compatíveis em *Rhodothermus marinus***", supervised by Prof. Helena Santos.

1998|1999: *Graduate Researcher* at **Instituto de Tecnologia Química e Biológica (UNL)**

Work entitled "**Role of N- γ -Acetyldiaminobutyrate as an Enzyme Stabilizer and an Intermediate in the Biosynthesis of Hydroxyectoine**", supervised by Prof. Helena Santos in collaboration with Prof. Ventosa from Departamento de Microbiologia e Parasitologia da Faculdade de Farmácia da Universidade de Sevilha, Spain.

1999|2004: *Doctoral Student (BD/19868/99 fellowship)* at **Instituto de Tecnologia Química e Biológica (UNL)**

Work entitled "**The Role of Mannosylglycerate in Thermo- and Osmo-Adaptation of *Rhodothermus marinus*: Biosynthesis, Regulation and Applications**", supervised by Prof. Helena Santos.

2003|March: *Doctoral Student (BD/19868/99 fellowship)* at **Centro de Neurociências, Universidade de Coimbra**

Short visit at laboratory of Prof. Milton da Costa for having training in *E. coli* genetic tools.

2004|2007: *Post-doctoral Student (BPD/14841/2003 fellowship)* at **Instituto de Tecnologia Química e Biológica (UNL)**

Work entitled "**Heat Stress Responses in *Rhodothermus marinus*: Role of Chemical Chaperones and Molecular Chaperones in Thermo-adaptation**", supervised by Prof. Helena Santos and co-supervised by Prof. José Berenguer de Carlos (Centro de Biología Molecular Severo Ochoa, Universidade Autónoma de Madrid, Spain).

2005|Jan-Jun: *Post-doctoral Student (BPD/14841/2003 fellowship)* at **Centro de Biología Molecular Severo Ochoa (Universidade Autónoma de Madrid, Spain)**

Work entitled "**Developing genetic tools for *Rhodothermus marinus* manipulation**", supervised by Prof. José Berenguer de Carlos.

2007|May-Jul: *Post-doctoral Student (BPD/14841/2003 fellowship)* at **Graduate School of Engineering (Kyoto University, Japan)**

Work entitled "**Construction of *thermococcus kodakaraensis* mutants**", supervised by Prof. H. Atomi and Prof. T. Imanaka.

2008|Present: Auxiliary Investigator (Ciência 2007) at Instituto de Tecnologia Química e Biológica (UNL)

4. Research Interests

Research Interests

Microbial Physiology; Biochemistry and Genetic manipulation of Hyperthermophiles and Thermophiles.

My present research interests are focused: in the elucidation of metabolic pathways of compatible solutes; in the identification and characterization of genes and enzymes involved in the synthesis of compounds restricted to (hyper)thermophiles; in the study of the regulation of the synthesis of compounds restricted to (hyper)thermophiles in relation to environmental conditions; in the development of genetic tools for the manipulation of hyperthermophiles and thermophiles; in the construction of mutants from (hyper)thermophiles; in the utilization of DNA microarrays and proteomics approaches to evaluate the expression levels of genes and proteins. Some of my other areas of expertise include: the cultivation of anaerobic hyperthermophiles; the identification, quantification, and structural characterization of new compatible solutes accumulated by thermophilic and hyperthermophilic organisms; the study of protein stabilization by compatible solutes; the identification of novel biosynthetic pathways and novel enzymes in (hyper)thermophiles; the purification of proteins and small organic molecules by liquid chromatography; the construction of genomic libraries in *E. coli*, and fishing genes by colony hybridization; the gene cloning and expression in *E. coli*, *Synorhizobium melioides*, *Sacharomyces cerevisiae*, and in thermophilic bacteria *Rhodothermus marinus* and *Thermus thermophilus* and hyperthermophilic archaeon *Thermococcus kodakaraensis*; and the biochemical characterization of novel enzymes.

Technical Skills

MICROBIOLOGY

Cultivation of hyperthermophilic anaerobic and thermophilic organisms in batch-feed and in fermentador.

BIOCHEMISTRY

Biochemical characterization of novel enzymes (kinetics parameters).

Characterization the accumulation of compatible solutes in several microorganisms.

Identification of novel biosynthetic pathways and novel enzymes in (hyper)thermophiles.

Purification of protein and small organic molecules by liquid chromatography (ion-exchange, gel filtration, hydrophobic, affinity).

Standard SDS-PAGE electrophoresis; 2-D electrophoresis (IEF/PAGE); protein electroelution from acrylamide gels.

MOLECULAR BIOLOGY

Cloning genes, and expression proteins in *E. coli*, *Synorhizobium melilotis*, *Sacharomyces cerevisiae*, and *Thermococcus kodakaraensis*.

Construction of a genomic library in *E. coli*, and finishing a gene by colony hybridization.

Colony, Southern and Western hybridization.

PCR amplification, plasmid construction, transformation, restriction and Southern analyses.

GENETIC MANIPULATION OF (HYPER)THERMOPHILES

Genetic manipulation of *Thermus thermophilus*, *Rhodothermus marinus* and *Thermococcus kodakaraensis*

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

One dimensional spectroscopy of the range of nuclei (including ^1H , ^{13}C , ^{31}P , and ^{39}K).

Structure determination of small molecules using two-dimensional homonuclear, and heteronuclear NMR correlation (COSY, HMQC, and HMBC).

IMMUNO-METHODS:

Western transfer and immunoblotting; affinity purification of antibodies.

5. Teaching

2005: Participation as an invited lecturer in the Ph.D. program of Centro de Neurociências e Biologia Celular at Coimbra University included in the module "Microbiology of Extreme Environments" presenting a class entitled "The Role of Compatible Solutes in Osmoadaptation and Thermoadaptation of the Thermophilic Bacterium *Rhodothermus marinus*". 27, October, Coimbra, Portugal.

2005: Participation as an invited lecturer in the Metabolic engineering course inscribed in the Cellular and Molecular Biology degree at Universidade Nova de Lisboa, lecturing on "Proteomics – Principles and Applications". 2, November, Oeiras, Portugal.

6. Co-Supervising Experience

Ph.D. students

2012|Present: Cristiana Silva Faria, Ph.D. student in the Cell Physiology and NMR group at Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa.

"Development of cell factories for the efficient production of mannosylglycerate, a thermolyte with great potential in biotechnology"

Co-supervised by Prof. Helena Santos and Dra. Isabel Rocha (Universidade do Minho)

2011|Present: Nádia Luísa Assunção Saraiva Castanheira,

"Nitrogen-fixing biofertilizers for gramineous crops"

Co-supervised by Dra. Paula Fareleira (Instituto Nacional de Recursos Biológicos, IP)

2009|Present: Ana Maria da Silva Esteves, Ph.D. student in the Cell Physiology and NMR group at Instituto de Tecnologia Química e Biológica, Universidade Nova de Lisboa.

"Unravelling the regulatory mechanisms in thermo-adaptation of hyperthermophilic archaea"

Co-supervised by Prof. Helena Santos

Master Student

2010: Cristiana Silva Faria

"Engineering *Saccharomyces cerevisiae* for the production of mannosylglycerate - a yeast model for assessing its application in protein stabilization"

Co-Supervised by Prof. Helena Santos

2009: Sónia de Fátima Estêvão Neto

"Unravelling Cell-to-Cell Communication in Archaea"

Co-Supervised by Prof. Helena Santos

7. Participation in Researcher Projects

Participation in research projects as project leader

1| Strategies of life adaptation to hot environments: Heat and osmotic stress responses in the extremely thermophilic bacterium RHODOTHERMUS MARINUS Programa FCT/FEDER, Project POCI/BIA-MIC/59310/2004 (fase II) 2005-2008, Project leader: Nuno Borges

- 2| Project FCT/FEDER, PTDC/AGR-AAM/100577/2008
Nitrogen-fixing biofertilizers for gramineous crops.
2010-2013, PIs: Paula Fareleira (INRB), Nuno Borges (ITQB), and Teresa Crespo (IBET).

Participation as a team member

- 1| Microrganismos em Ambientes Extremos: Mecanismos de Adaptação
Programa PRAXIS XXI, Projecto PRAXIS/2/2.1/BIO/20/94
1994-1998, Project leader: Prof. Helena Santos
- 2| Estratégias Bioquímicas de Termo-Estabilização em Microrganismos Hipertermófilos
Programa PRAXIS XXI, Projecto PRAXIS/2/2.1/BIO/1109/95
1996-1999, Project leader: Prof. Helena Santos
- 3| Extremophiles as Cell Factories
Project BIOTECH CE-DGXII, contrat nºBIO 4-CT 960488
1996-1999, European co-ordinator: Prof. Garo Antranikian
- 4| Exploração de Solutos de Organismos Hipertermófilos com vista à sua Utilização como Estabilizantes de Enzimas
FCT/PRAXIS XXI, Project PRAXIS/P/BIO/12082/1998
2000-2002, Project leader: Prof. Helena Santos
- 5| Exploiting New Solutes from Hyperthermophiles for the Preservation of Biomaterials: Cell Factories for Production of Hypersolutes
Projecto aprovado no âmbito do V Programa Quadro da União Europeia (contrato nº QLK3-CT-2000-00640)
2001-2004, European Coordinator: Prof. Helena Santos
- 6| Towards the Utilization of Cell-Reactors for the Production of Mannosylglycerate, an Enzyme Stabilizer from Hyperthermophiles
Programa FCT/Sapiens99, Projecto POCTI 35715/BIO/2000
2001-2004, Project leader: Prof. Milton da Costa
- 7| HOTSOLUTES - New applications for compatible solutes from extremophiles
Projecto aprovado no âmbito do VI Programa Quadro da União Europeu (contrato nº COOP-CT-2003-508644)
2004-2006, European Coordinator: STAB-VIDA
- 8| Strategies of life adaptation to hot environments: Heat and osmotic stress responses in the extremely thermophilic bacterium *Rhodothermus marinus*
Programa FCT/FEDER, Projecto POCI/BIA-MIC/59310/2004
2005-2008, Project leader: Prof. Helena Santos
- 9| Lessons from the physiology of hyperthermophilic microorganisms: potential of new biomolecules to inhibit protein misfolding and aggregation

Projecto POCI V.5.1 A004/2005
2005-2008, Project leader: Prof. Helena Santos

- 10|** Molecular Adaptation to Extreme Environments: Structural Studies of Proteins Involved in the Synthesis of Osmolytes in (hyper)thermophilic micro-organisms
Projecto PTDC/QUI/71142/2006
2008-2010, Project leader: Dr. Pedro Matias
- 11|** Understanding how hyperthermophilic microorganisms cope with heat stress: the role of unique polyolphosphodiester compounds
Projecto PTDC/BIA-MIC/71146/2006
2008-2011, Project leader: Prof. Helena Santos

8. Communications in Scientific Meetings

Oral Communications by Invitation

- 1|** Specialized roles of the two pathways for the synthesis of mannosylglycerate in osmoadaptation and thermoadaptation of *Rhodothermus marinus*.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
"5th International Conference on Extremophiles" September 19-23, 2004, Cambridge, Maryland, USA.
- 2|** The role of compatible solutes in osmoadaptation and thermoadaptation of the thermophilic bacterium *Rhodothermus marinus*: biosynthesis and regulation.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
"Micro'05 – Biotec'05", November 30 to December 3, 2005, Póvoa do Varzim, Portugal.
- 3|** Kinetic and structural characterization of the enzymes involved in the synthesis of di-*myo*-inositol-phosphate in *Archaeoglobus fulgidus*.
N. Borges, M. V. Rodrigues, J. Brito, M. Archer & H. Santos.
"7th International Conference on Extremophiles" September 7-11, 2008, Cape Town, South africa.
- 4|** Role, evolution and regulation of the synthesis of di-*myo*-inositol-phosphate in hyperthermophiles.
N. Borges
"The 11th International Conference on Thermophiles Research"
September 11-16, 2011, Big Sky, Montana, EUA.
- 5|** Biosynthesis, evolution and role of unique compatible solutes in heat stress adaptation of marine hyperthermophiles
N. Borges
"9th International Congress on Extremophiles" September 11-13, 2012, Sevilla, Spain.

Poster Communications

- 1|** Effect of mannosylglycerate and related compounds on the thermal stability of model enzymes.
N. Borges, A. Ramos, N. Raven, R. Sharp & H. Santos.
"International Conference – Thermophiles '98", 6-11, September, 1998, Brest, France.
- 2|** Comparative study of performance of mannosylglycerate and other organic solutes in the thermoprotection of model enzymes.
N. Borges, A. Ramos, N. Raven, R. Sharp & H. Santos.
"3rd Meeting on Extremophiles as cell Factories", 3-6, June, 1999, Graz, Austria.
- 3|** Comparative study of performance of mannosylglycerate and other organic solutes in the thermoprotection of model enzymes.
N. Borges, A. Ramos, N. Raven, R. Sharp & H. Santos.
"XX Congresso Brasileiro de Microbiologia", 24-28, October, 1999, Salvador, Brazil.
- 4|** Effect of mannosylglycerate and other compatible solutes on the thermal stability of model enzymes: a comparative study.
N. Borges, A. Ramos, N. Raven, R. Sharp & H. Santos.
"2nd International Conference on Protein Stabilisation", 9-12, April, 2000, Lisbon, Portugal.
- 5|** Characterisation of the phosphorylating pathway for the synthesis of mannosylglycerate in *Rhodothermus marinus*.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
"4th International Congress of extremophiles", 23-26, October, 2002, Naples, Italy.
- 6|** Biochemical and genetic characterization of the two pathway for the synthesis of mannosylglycerate in the thermophilic bacterium *Rhodothermus marinus*.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
"1st FEMS Congress of European Microbiologists", 29, June – 3, July, 2003, Ljubljana, Eslovénia.
- 7|** Biochemical and genetic characterisation of the two pathway for the synthesis of mannosylglycerate in *Rhodothermus marinus*.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
"Gordon Research Conference on Cellular Osmoregulation: Sensors, Transducers and Regulators", 10-15, August, 2003, Bristol, EUA.
- 8|** The two pathways for the synthesis of trehalose in *propionibacterium freudenreichii*: biochemical and genetic characterisation.
F. S. Cardoso, R. F. Castro, **N. Borges** & H. Santos.

"1st International Conference on Environmental, Industrial and Applied Microbiology (BioMicroWorld-2005)", 15-18, March, 2003, Badajoz, Spain.

- 9|** Projects involving proteomics in the cell physiology and NMR lab at ITQB.
A. R. Neves, **N. Borges**, P. Gaspar & H. Santos.
"2nd Annual Meeting of the Portuguese Proteomic Network – ProCura", 29, November, 2004, Lisbon, Portugal. Presented orally by A. R. Neves.
- 10|** Pathways for the synthesis of diglycerol phosphate, di-*myo*-inositol phosphate, and glycerolphosphoinositol in *Archaeoglobus fulgidus*.
M. V. Rodrigues, L. G. Gonçalves, F. Siopa, R. Ventura, C. Maycock, P. Lamosa, **N. Borges** & H. Santos.
"International Conference on Extremophiles 2006", 17-21, September, 2006, Brest, France.
- 11|** Genetic tools to elucidate the role of mannosylglycerate in osmo- and thermo-adaptation of *Rhodothermus marinus*.
N. Borges, J. Berenguer & H. Santos.
"International Conference on Extremophiles 2006", 17-21, September, 2006, Brest, France.
- 12|** The biosynthetic pathways of polyol-phosphodiester by *Archaeoglobus fulgidus* in stress adaptation.
M. V. Rodrigues, L. G. Gonçalves, F. Siopa, R. Ventura, C. Maycock, P. Lamosa, **N. Borges** & H. Santos.
"XVth National Congress of Biochemistry", 8-10, December, 2006, Aveiro, Portugal. Presently orally by M. V. Rodrigues.
- 13|** Assessing the contribution of di-*myo*-inositol phosphate during stress adaptation of *Thermococcus kodakaraensis*.
N. Borges, R. Matsumi, H. Atomi, T. Imanaka & H. Santos.
"7th International Conference on Extremophiles 2006", 17-21, September, 2006, Brest, France.
- 14|** A novel mannosyltransferase of *Thermotoga maritima* that uses di-*myo*-inositol phosphate as glycosyl acceptor.
M. V. Rodrigues, **N. Borges**, P. Lamosa & H. Santos.
"7th International Conference on Extremophiles 2006", 17-21, September, 2006, Brest, France.
- 15|** Crystallization and preliminary structural analysis of mannosyl-3-phosphoglycerate synthase from *Thermus thermophilus* HB27.
S. M. P. Gonçalves, **N. Borges**, H. Santos & P. Matias.
"The 9th International School on the Crystallography of Biological Macromolecules Società del Casino", 29th September – 3rd October, 2008, Como, Italy.

- 16|** A novel mannosyltransferase involved in the stress response of the hyperthermophilic bacterium *Thermotoga maritima*.
M.V. Rodrigues, **N. Borges**, P. Lamosa, H. Santos.
"3rd Congress of European Microbiologists – FEMS 2009", June 28 - July 2, 2009, Gothernburg, Sweden.
- 17|** Mutants of *Thermococcus kodakaraensis* to assess the role of di-*myo*-inositol phosphate in stress adaptation of this hyperthermophilic archaeon.
N. Borges, R. Matsumi, H. Atomi, T. Imanaka, H. Santos.
"3rd Congress of European Microbiologists – FEMS 2009" June 28 - July 2, 2009, Gothernburg, Sweden.
- 18|** Evolutionary analysis of enzymes involved in the synthesis of di-*myo*-inositol-phosphate.
L.G. Gonçalves, **N. Borges**, P. Fernandes, H. Dopazo, H. Santos.
MICRO:BIOTEC09, 28-30 November 2009, Vilamoura, Portugal.
Presently orally by L.G. Gonçalves.
- 19|** Structural analysis of *Thermus thermophilus* HB27 mannosyl-3-phosphoglycerate synthase.
S. Gonçalves, **N. Borges**, A.M. Esteves, B. Victor, C.M. Soares, H. Santos, P.M. Matias.
"8th International Conference on Extremophiles" 12-16, September, 2010, Ponta Delgada, Azores, Portugal.
- 20|** What is the role of mannosylglycerate *in vivo*? Hints from fluorescence microscopy using a yeast model of Parkinson's disease.
C. Faria, **N. Borges**, S. Tenreiro, T. Outeiro and H. Santos
"8th International Conference on Extremophiles", 12-16, September, 2010, Ponta Delgada, Azores, Portugal.
- 21|** The X-ray structure of CTP:inositol-1-phosphate cytidyltransferase from *Archaeoglobus fulgidus*.
J.A. Brito, **N. Borges**, H. Santos, M. Archer
"8th International Conference on Extremophiles" 12-16, September, 2010, Ponta Delgada, Azores, Portugal.
- 22|** Unravelling the evolutionary history of enzymes catalyzing the synthesis of di-*myo*-inositol phosphate, an osmolyte restricted to (hyper)thermophiles.
L.G. Gonçalves, **N. Borges**, P. Fernandes, H. Dopazo and H. Santos.
"8th International Conference on Extremophiles", 12-16, September, 2010, Ponta Delgada, Azores, Portugal.
- 23|** An overview on the biosynthesis of di-*myo*-inositol phosphate and other inositol derivatives accumulating in hyperthermophiles during heat stress.
M.V. Rodrigues, **N. Borges**, L. G. Gonçalves, P. Lamosa and H. Santos.
"8th International Conference on Extremophiles", 12-16, September, 2010, Ponta Delgada, Azores, Portugal.

- 24|** L. G. Gonçalves, N. Borges, F. Serra, P. L. Fernandes, H. Dopazo, H. Santos "Evolution of the biosynthesis of di-*myo*-inositol phosphate, a marker of adaptation to hot marine environments" Microbiotec 2011, 1-3 December 2011, Braga, Portugal.
- 25|** C. D. Jorge, C. Faria, N. Borges, S. Tenreiro, T. Outeiro, H. Santos "Mannosylglycerate, a compatible solute widespread in hyperthermophiles, inhibits a-synuclein aggregation in the cytoplasm of yeast cells" Microbiotec 2011, 1-3 December 2011, Braga, Portugal.
- 26|** L. G. Gonçalves, N. Borges, P. Fernandes, H. Dopazo, H. Santos "Evolutionary analysis of the biosynthesis of glyceryl-glucosides" 9th International Congress on Extremophiles, September 11-13, 2012, Sevilla, Spain.
- 27|** A. M. Esteves, S. K. Chandrayan, P. M. McTernan, M. W. Adams, N. Borges, H. Santos "Mutants of *Pyrococcus furiosus* as a means to study the roles of mannosylglycerate and di-*myo*-inositol phosphate in stress adaptation" 9th International Congress on Extremophiles, September 11-13, 2012, Sevilla, Spain.
- 28|** C. D. Jorge, N. Borges, H. Santos "The intriguing inositol-1-phosphate cytidyltransferase activity of *Rhodothermus marinus*" 9th International Congress on Extremophiles, September 11-13, 2012, Sevilla, Spain.
- 29|** M. V. Rodrigues, R. Ventura, C. Maycock, N. Borges, H. Santos "The biosynthesis of glycerophosphoinositol: do Archaea «like» to be different?" 9th International Congress on Extremophiles, September 11-13, 2012, Sevilla, Spain.

9. Publications Subjected to Referring

- 1|** Combined effect of the growth temperature and salinity of medium on the accumulation of compatible solutes by *Rhodothermus marinus* and *Rhodothermus obamensis*.
Z. Silva*, **N. Borges***, L.O. Martins, R. Wait, M.S. da Costa & H. Santos.
Extremophiles, **3**, 63-172 (1999). **IF:2.16, CT: 56, *Equal contribution.**
- 2|** Role of N γ -acetyldiaminobutyrate as enzyme stabilizer and intermediate in the biosynthesis of hydroxyectoine.
D. Cánovas*, **N. Borges***, C. Vargas, A. Ventosa, J. J. Nieto & H. Santos
Applied and Environmental Microbiology, **65**, 3774-3779 (1999). **IF: 3.389, CT: 45, *Equal contribution.**
- 3|** Pathway for the synthesis of mannosylglycerate in the hyperthermophilic archaeon *Pyrococcus horikoshii*. Biochemical and genetic characterization of key enzymes.
N. Empadinhas, J. D. Marugg, **N. Borges**, H. Santos & M. S. da Costa

Journal of Biological Chemistry, **276**, 43580-43588 (2001). **IF: 7.258, CT: 46.**

- 4|** Comparative study of the thermostabilizing properties of mannosylglycerate and other compatible solutes on model enzymes.
N. Borges, A. Ramos, N. D. Raven, R. J. Sharp & H. Santos.
Extremophiles, **6**, 209-216 (2002). **IF: 2.165, CT: 69.**
- 5|** Specialized Roles of the two pathways for the synthesis of mannosylglycerate in osmoadaptation and thermoadaptation of *Rhodothermus marinus*.
N. Borges, J. D. Marugg, N. Empadinhas, M. S. da Costa & H. Santos.
Journal of Biological Chemistry, **279**, 9892-9898 (2004). **IF:6.355, CT:30.**
- 6|** Biosynthetic pathways of inositol and glycerol phosphodiester used for stress adaptation in *Archaeoglobus fulgidus*.
N. Borges, L.G. Gafeira, M.V. Rodrigues, R. Ventura, C. Maycock, P. Lamosa & H. Santos.
Journal of Bacteriology, **188**, 8128-8135 (2006). **IF: 3.993, CT:8.**
- 7|** Biochemical and genetic characterization of the pathways for trehalose metabolism in *Propionibacterium freudenreichii* and their role in stress response.
F. S. Cardoso, R. F. Castro, **N. Borges** & H. Santos.
Microbiology-SGM, **153**, 271-281 (2007). **IF: 3.110, CT:24.**
- 8|** Bifunctional CTP:inositol-1-phosphate cytidyltransferase/ CDP-inositol:inositol-1-phosphate transferase, the key enzyme for di-*myo*-inositol-phosphate synthesis in several (hyper)thermophiles.
M.V. Rodrigues, **N. Borges**, M. Henriques, P. Lamosa, R. Ventura, C. Fernandes, N. Empadinhas, C. Maycock, M. S. da Costa & H. Santos.
Journal of Bacteriology, **189**, 5405-5412 (2007). **IF:4.013, CT:16.**
- 9|** A unique beta-1,2-mannosyltransferase of *Thermotoga maritima* that uses di-*myo*-inositol phosphate as mannosyl acceptor.
M. V. Rodrigues, **N. Borges**, C. P. Almeida, P. Lamosa & H. Santos.
Journal of Bacteriology, **191**:6105-6115 (2009). **IF: 3.940, CT:7.**
- 10|** Crystallization and preliminary X-ray analysis of mannosyl-3-phosphoglycerate synthase from *Thermus thermophilus* HB27.
S. Gonçalves, **N. Borges**, H. Santos & P.M. Matias.
Acta Crystallogr Sect F Struct Biol Cryst Commun. **65**(Pt 10):1014-7 (2009)
IF:0.551, CT:3.
- 11|** *Thermococcus kodakarensis* mutants deficient in di-*myo*-inositol phosphate use aspartate to cope with heat stress.
N. Borges, R. Matsumi, T. Imanaka, H. Atomi & H. Santos
Journal of Bacteriology, **192**, 191-197 (2010). **IF: 3.726, CT:6.**

- 12|** Structural analysis of *Thermus thermophilus* HB27 mannosyl-3-phosphoglycerate synthase provides evidence for a second catalytic metal ion and new insight into the retaining mechanism of glycosyltransferases.
S. Gonçalves, **N. Borges**, A.M. Esteves, B.L. Victor, C.M. Soares, H. Santos and P.M. Matias.
Journal of Biological Chemistry, **285**:17857-17868 (2010). **IF: 5.328, CT:6.**
- 13|** Production, crystallization and preliminary X-ray analysis of CTP:inositol-1-phosphate cytidyltransferase from *Archaeoglobus fulgidus*.
J.A. Brito, **N. Borges**, H. Santos & M. Archer.
Acta Crystallogr Sect F Struct Biol Cryst Commun, **F66**:1463–1465 (2010). **IF: 0.563; CT:1.**
- 14|** Crystallization and preliminary X-ray analysis of mannosyl-3-phosphoglycerate phosphatase from *Thermus thermophilus* HB27.
S. Gonçalves, A. Esteves, **N. Borges**, H. Santos & P.M. Matias.
Acta Crystallogr Sect F Struct Biol Cryst Commun **F67**:390-396 (2011).
IF: 0.506; CT:1.
- 15|** Crystal structure of *Archaeoglobus fulgidus* CTP:inositol-1-phosphate cytidyltransferase, a key enzyme for di-*myo*-inositol-phosphate synthesis in (hyper)thermophiles.
J.A. Brito, **N. Borges**, C. Vonrheinb, H. Santos, and M. Archer.
Journal of bacteriology, **193**:2177-85 (2011).
IF: 3.825; CT:2.
- 16|** The three-dimensional structure of mannosyl-3-phosphoglycerate phosphatase from *Thermus thermophilus* HB27: a new member of the Haloalkanoid Acid Dehalogenase Superfamily.
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10. Chapters in Books

- 1|** Characterization and quantification of compatible solutes in (hyper)thermophilic microorganisms.
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- 2|** The physiological role, biosynthesis and mode of action of compatible solutes from (hyper)thermophiles.
H. Santos, P. Lamosa, T. Q. Faria, **N. Borges** & C. Neves.
Physiology and biochemistry of extremophiles, 86-104 (2007)
Eds: C. Gerday & N. Glandorff, ASM publishers, Washington, D. C.
- 3|** Organic compatible solutes of prokaryotes that thrive in hot environments: the importance of ionic compounds for thermostabilization.
H. Santos, P. Lamosa, **N. Borges**, L.G. Gonçalves, T.M. Pais & M.V. Rodrigues
Extremophiles Handbook, Part 4, pp. 497-520 (2011)
Eds: K. Horikoshi, G. Antranikian, A.T. Bull, F.T. Robb & K.O. Stetter, Springer, Tokyo.

11. Congress Organization

- 1|** "8th International Conference on Extremophiles" 12-16, September, 2010, Ponta Delgada, Azores, Portugal. H. Santos (Chair), **N. Borges** (Co-chair) & P. Lamosa (Co-chair).