

Personal data

Cláudia Nunes dos Santos

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Academic degrees

2006-PhD in Biochemistry-FCL, Lisboa.

1993-degree in Biochemistry- FCL, Lisboa.

Previous and current scientific and/or professional activities

- From 1993 to 1995- post graduate student at ISA/ITQB;
- From 1996- 2006 PhD student at FCL/ITQB;
- From October 1998-October 1999- Assistant professor at Instituto Superior de Estudos Interculturais e Transdisciplinares from Instituto Piaget
- From 1st October 1999 to 31th October 2005- Assistant professor at Escola Superior Agrária from Santarém;
- Since October 2006 post-doc at ITQB/INSA and FF.
- Since 2012 honorary research fellow at James Hutton Institute in Dundee, Scotland, UK.

Area of scientific activity

Biochemistry and molecular biology

Present research interests

Study of the effect of plant phenolic compounds on neurodegenerative diseases that affect man, and of Parkinson's disease in particular. The main areas of research are: biochemical profiling of polyphenols extracted from selected plant sources; screening and selection of the polyphenols for biological activity (antioxidant and cytoprotective activities) in neuronal cell lines; effects on the rotenone-induced neurodegeneration cell model of Parkinson disease through the ubiquitin/proteasome pathway, a proteomic analysis and a transcriptomic analysis.

Academic activities

- Coordination of the Disease & Stress Biology (D&SB) research group-ITQB pole, in collaboration with Prof Ricardo Ferreira.
- Supervision of many final-year undergraduates (13), Master of Science (5) as well as other post-graduates (3). Currently involved in the supervision of 2 post-doc, 4 Ph.D. students and 5 Master of Science.
- Projects
 - Coordination of research project from Fundo EDP para a Biodiversidade “Conservation and Recovery of Threatened endemic Flora in Portugal”-IBET pole.
 - Leader of the iBET team in EU project EUBerry: “The sustainable

- improvement of European berry production, quality and nutritional value in a changing environment”. (EUBerry FP7-KBBE-2010-265942).
 - PTDC/BIA-BCM/111617/2009: “Polyphenols as protective agents in cellular models of alpha-synucleinopathies, in particular Parkinson’s disease”.
 - Team member of 7 projects (national and EC).
- Member of collaborative network:
 - COST 863: Euroberry Research: from Genomics to Sustainable Production, Quality & Health since 2007
 - COST FA1005- Improving health properties of food by sharing our knowledge on the digestive process (INFOGEST), member of the management committee since 2011.
 - EPSO Crops, Food and Health working group, since 2011.
- Member of Scientific societies: Portuguese Biochemical Society; Portuguese Society of Plant Physiology; Groupe Polyphenols; GA-Society for Medicinal Plant and Natural Product Research; SPFito - Sociedade Portuguesa de Fitoquímica e Fitoterapia
- Member or organizing/scientific committee of following meetings:
 - “COST863 Management Committee and Workshop on ‘Defining needs of berry industries’, Oeiras, 19 th to 21st of March 2009.
 - IV Colóquio Nacional da Produção de Pequenos Frutos, Faro, 20 th to 21 st of April 2012.
- Referee in Scientific Journals: J. Agricultural and Food Chemistry; Journal of Nutritional Biochemistry, Food Chemistry; Water research; J. Berry Research; Molecules
- Scientific collaborations
 - International:
 - Derek Stewart, Enhancing Crop Productivity and Utilisation, James Hutton Institute, Invergowrie, Dundee, Scotland, UK;
 - Gary Williamson, School of Food Science and Nutrition, University of Leeds, Leeds, UK;
 - Bruno Mezzeti, Dipartimento di Scienze Agrarie, Alimentari e Ambientali Facoltà di Agraria, Università Politecnica delle Marche, Ancona, Italy;
 - Rosita Gabbianelli, Associate Professor of Biochemistry and Molecular Biology, School of Pharmacy, University of Camerino, Italy;
 - Dr Catherine Brenner Jan, INSERM U769-LabEx LERMIT, Université Paris-Sud, Malabry, France;
 - Marianne G. Rots, Professor of Molecular Epigenetics, Dept Pathology and Medical Biology, University Medical Center Groningen, Netherlands;
 - National
 - Paula M. Alves, Animal Cell Technology Lab, ITQB/IBET, Oeiras, Portugal;
 - Cristina Silva Pereira, Applied and Environmental Mycology, ITQB/IBET, Oeiras, Portugal
 - Célia Miguel, Forest Biotech Lab, ITQB/IBET, Oeiras, Portugal;
 - Catarina Duarte, Nutraceuticals and Controlled Delivery Lab, IBET, Oeiras, Portugal;
 - Helena L. A. Vieira, Biology of Cytoprotection Lab, CEDOC, Oeiras, Portugal;
 - Tiago Outeiro, Cell and Molecular Neuroscience Unit, IMM, Lisboa, Portugal;

- Rui Gardner, FlowLabUIC, IGC, Oeiras, Portugal;
- Jörg Becker, Plant Genomics, IGC, Oeiras, Portugal;
- Carlos Aguiar, Centro de Investigação da Montanha, IPB-ESA, Bragança, Portugal;
- Dora Brites e Alexandra Brito, Neuron Glia Biology in Health and Disease, iMed, Faculdade de Farmácia, Portugal
- Pedro Oliveira, Unidade de Sistemas Agrários e Desenvolvimento, INIA, INRB, Oeiras, Portugal;
- Adelaide Clemente, Jardim Botânico e Museu Nacional de História Natural, Lisboa, Portugal;
- Dalila Espírito Santo, Jardim Botânico da Ajuda, ISA, Lisboa, Portugal;
- Lígia Salgueiro, Laboratório de Farmacognosia, FFUC, Coimbra, Portugal

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Publications

In books:

1. Ferreira R, Monteiro S, Freitas R, Santos C, Chen Z, Batista L, Duarte J, Borges A, Teixeira A (2007) Plant/Fungal Interactions Studied at the Molecular Level in Plant Pathology Concepts and Laboratory Exercises, Robert N Trigiano, Mark T Windham, Alan S Windham Eds, 2nd Ed, CRC Press.

In International Scientific Journals:

1. Santos CN, Ferreira RB, Teixeira AR (1997) “Seed proteins of *Lupinus mutabilis*”, J Agric Food Chem 45: 3821-3825. (Citations 20 ,IF 2.823).
2. Santos C, Gaspar M, Caeiro AS, Branco-Price C, Teixeira AR, Ferreira RB, (2006) “Exposure of *Lemna minor* to arsenite: expression levels of the components and intermediates of the ubiquitin/proteasome pathway”, Plant Cell Physiol 47: 1262-1273. (Citations 5 ,IF 4.702).
3. Ferreira RB, Monteiro S, Freitas R, Santos CN, Chen Z, Batista LM, Duarte J, Borges A, Teixeira AR (2006) Fungal pathogens: The battle for plant infection. Crit Rev Plant Sci 25: 505-524. (Citations 18, IF 4.659).
4. Ferreira RB, Monteiro S, Freitas R, Santos CN, Chen Z, Batista LM, Duarte J, Borges A, Teixeira AR (2007) "The role of plant defence proteins in fungal pathogenesis", Mol Plant Path 8: 677–700. (Citations 64 ,IF 3.899).
5. Menezes R, Amaral C, Batista-Nascimento L, Santos C, Eleutherio E, Ferreira R, Devaux F, Rodrigues-Pousada C (2008) "Contribution of Yap1 towards *S. cerevisiae* adaptation to arsenic mediated oxidative stress” Biochem J 414: 301–311. (Citations 10,IF 4.897).
6. Fortalezas S, Tavares L, Pimpão R, Tyagi M, Pontes V, Alves PM, McDougall GJ, Stewart D, Ferreira R, Santos CN (2010) “Antioxidant properties and neuroprotective capacity of strawberry tree fruit (*Arbutus unedo*)”, Nutrients, 2: 214-229. (Citations 6, IF 0.676, corresp. author).
7. Tavares L, Fortalezas S, Carrilho D, McDougall GJ, Stewart D, Ferreira RB, Santos CN (2010) “Antioxidant and antiproliferative properties of strawberry tree tissues”, J Berry Research, 1:3-12. (corresp. author).
8. Tavares L, Carrilho D, Barata D, Serra T, Duarte C, Feliciano R, Bronze R, Duarte R, Chicau P, Espírito-Santo D, Teixeira A, Ferreira R, Santos CN (2010) “Antioxidant capacity of Macaronesia traditional medicinal plants”, Molecules, 15: 2576-2592. (Citations 7, IF 2.386, corresp.author).

9. Tavares L, Alves PM, Ferreira RB, Santos CN (2011) "Comparison of different methods for DNA-free RNA isolation from SK-N-MC neuroblastoma", BMC Research Notes, 4:3. (Citations 5, corresp. author).
10. Pinto MP, Santos CN, Henriques C, Lima G, Quedas F, (2011)" Lycopene content and antioxidant capacity of Portuguese watermelon fruits", EJEAFChe, 10: 2090-2097.
11. Tavares L, Fortalezas S, Tyagi M, Barata D, Serra T, Duarte C, Duarte R, Feliciano R, Bronze MR, Espírito-Santo MD, Ferreira RB, Santos CN (2012) "Bioactive compounds from endemic plants of Southwest Portugal: Inhibition of acetylcholine esterase and radical scavenging activities" Pharm Biol 50, 239-246. (IF 0.878, corresp. author).
12. Tavares L, Figueira I, Macedo D, McDougall GJ, Leitão, MC, Vieira HLA, Stewart D, Alves PM, Ferreira RB, Santos CN (2012) "Neuroprotective effect of blackberry (*Rubus sps*) polyphenols is potentiated after simulated gastrointestinal digestion" Food Chem, 131(4), 1443-1452. (Citations 3, IF 3.655, corresp. author).
13. Tavares L, McDougall GJ, Fortalezas S, Stewart D, Ferreira RB, Santos CN (2012) The neuroprotective potential of phenolic-enriched fractions from four Juniperus species found in Portugal. Food Chem, 135, 562-70. (IF 3.655, corresp. author).
14. Santos CN, Alves M, Bento I, Ferreira RB (2012) A missing piece in the protein deposition and mobilization inside legume seed in the storage vacuoles: calcium and magnesium, Seed Science Research, 22, 249-258 (IF 1.059).
15. Tavares L, Figueira I, McDougall GJ, Vieira HLA, Stewart D, Alves PM, Ferreira RB, Santos CN (2013) Neuroprotective effects of digested polyphenols from wild blackberry species. Eur J Nutr, 52, 225-36. (IF 2,750, corresp. author).
16. Tavares L, Pimpão RP, McDougall GJ, Stewart D, Ferreira RB, Santos CN*. Understanding polyphenols production in *Juniperus* sp.: seasonality and response to stress situations J. Agric. Food Chem (accepted).
17. Santos CN, Alves M, Ferreira RB "Purification and characterization of beta-N-acetylhexosaminidase from *Lupinus albus* seeds." (accepted).
18. Pimpão R. C., Dew T., Oliveira P. B., Williamson G., Ferreira R. B., Santos C. N. Analysis of phenolics in Portuguese wild and commercial berries after multi-enzyme hydrolysis. J. Agric. Food Chem. (accepted).
19. Oliveira M, J.Pereira, S.C.Verde, M.G.Lima, P.Pinto, P.B. de Oliveira, C.Junqueira, H.Marcos, T.Silva, R.Melo, C.N.Santos, M. L. Botelho, "Evaluation of potential of gamma radiation as a conservation treatment for blackberry fruits" (accepted).

Submitted papers

1. Santos CN, Tavares L, Martins IL, Ricardo CP, Teixeira AR, Ferreira RB, "Influence of the cell redox state on the response of *Lemna minor* proteome to arsenite" (submitted).
2. Santos CN, Teixeira AR, Ferreira RB "The supply of protein substrates for the ubiquitin/proteasome pathway depends upon the redox state of *Lemna minor* cells" (submitted).

In preparation

1. Carvalho M, Santos CN, Caeiro AS, Monteiro S, Teixeira AR, Ferreira RB "Role of the Ubiquitin/proteasome pathway in *Vitis vinifera*/*Uncinula necator* compatible interaction" (in preparation).
2. Macedo D, Tenreiro S, Outeiro T, Ferreira RB, Santos CN. "Polyphenol enriched fractions with protective effect in Parkinson's disease yeast model" (in preparation).
3. Cardoso S, Pinto P, Lima G, Pimpão R, Tavares L, Ferreira RB, Santos CN "Daily

polyphenol intake from fruits by Portuguese population: berry fruit contribution” (in preparation).

4. Santos CN, Duarte D, Barata D, Tavares L, Carrilho D, Teixeira A, Alves P, Ferreira R (2011) “Phytochemical evaluation of *Quercus* species - Antioxidant properties of *Q. suber* leaves in a neurodegeneration cell model” (in preparation).
 5. Pimentel C, Caetano S, Menezes R, Figueira I, Santos CN, Carreto L, Ferreira RB, Rodrigues-Pousada C The role of the yeast transcription factor Yap1 in cobalt detoxification (in preparation).
 6. Tavares L, Gardner R, Jorg B, Ferreira RB, Santos CN Differential expression of genes involved in neuroprotection conferred by blackberry polyphenols derived from digestion, (in preparation).
 7. Matias A, Nunes S, Poejo J, Figueira I, Mecha E, Santos CN, Ferreira RB, Serra AT, Bronze MR, Duarte CMM *Opuntia ficus indica* polyphenolic-rich extract as potential modulator of intestinal inflammation – A nutritional approach for Inflammatory Bowel Diseases? (in preparation).
 8. Serra AT, Nunes S, Figueira I, Santos CN, Ferreira RB, Bronze MR, Matias AA, Duarte CMM Protective effect of a Polyphenol-rich extract derived from sweet cherries culls against oxidative cell damage in human intestinal epithelial cell-model (in preparation).
- Fortalezas S, Figueira I, Pimpão R, Miguel C, Aguiar C, Ferreira RB, Santos CN, In vitro micropropagation of endangered *Antirrhinum lopesianum* and production of phenolics and flavonoids (in preparation).

Gene and protein sequences:

- 49 sequences submitted at NCBI

Abstracts in international scientific periodicals with referees:

1. Tavares L, Pimpão RC, Santos C, McDougall GJ, Stewart D, Ferreira RB. Phytochemical characterization of *Juniperus spp.* leaves. 57th International Congress and Annual Meeting of the GA. August 16 – 20, Geneva, Switzerland. *Planta Med* 2009. 75, 923.
2. Santos C, Tavares L, Fortalezas S, Carrilho D, Pontes V, McDougall GJ, Stewart D, Ferreira RB. 2009. Neuroprotective and MMP-9 inhibitory activity of hydroethanolic extract of *Arbustus unedo* leaves. 57th International Congress and Annual Meeting of the GA. August 16 – 20, Geneva, Switzerland. *Planta Med* 2009. 75, 924.

Papers in conference proceedings with referee:

3. Santos CN, Ferreira RB, Teixeira AN, Freitas RM (1996) “Characterisation of *Lupinus mutabilis* (cv. Potosi) seed storage proteins”. Proceedings of the Eighth International Lupin Conference, Pacific Grove, USA, pp 211-213.
4. Santos CN, Ferreira RB, Teixeira AN (1996) “Cold Tolerance studies with two *Lupinus mutabilis* cultivars”. Proceedings of the Eighth International Lupin Conference, Pacific Grove, USA, pp 455-458.
5. Santos C, Ferreira R, Teixeira A (1998) “Preliminary characterisation of a glycosidase possibly involved in the mobilisation of storage proteins from *Lupinus albus* seeds”. Proceedings of the 3rd European Conference on Grain Legumes, Valladolid, Spain, pp 296-297.
6. Santos C, Rajasekhar T, Ferreira R, Teixeira A (2004) “Cation content of the

- protein storage vacuoles from *Lupinus albus* cotyledons”. Proceedings of the 10th International Lupin Conference, Laugarvatn, Iceland, pp 294-295.
7. Carrilho D, Tavares L, Barata D, Santos C, Serra T, Duarte R, Duarte C, Espírito-Santo D, Teixeira A, Ferreira R (2008) “Antioxidant properties and phytochemical analysis of an uncharacterized Portuguese endemic aromatic herb, *Thymus capitellatus*”. Proceedings of the XXIVth International Conference on Polyphenols, Salamanca, Spain, Vol. 2 pp 467-469.
 8. Tavares L, Barata D, Santos C, Carrilho D, Serra T, Feliciano R, Duarte C, Bronze R, Oliveira P, Ferreira R (2008) “Phytochemical characterization of leaf and root tissues from raspberry, including antioxidant activity evaluation”. Proceedings of the XXIVth International Conference on Polyphenols, Salamanca, Spain, Vol. 1 pp. 407-409.
 9. Santos C, Duarte D, Barata D, Tavares L, Carrilho D, Serra T, Teixeira A, Duarte C, Alves P, Ferreira R (2008) “Phytochemical evaluation of *Quercus* species- Antioxidant properties of *Q. suber* leaves in a neurodegeneration cell model”. Proceedings of the XXIVth International Conference on polyphenols, Salamanca, Spain, Vol 2. pp. 789-791.
 10. Tavares L, Pimpão R, Ferreira RB, Santos CN (2010) “Phenolics biosynthesis in response to stress conditions in *Juniperus* sp.”, Proceedings of the XXVth International Conference on polyphenols, Montpellier, France, 261-262pp.
 11. Pimpão R, Tavares L, Oliveira P, Ferreira R, Santos CN (2010) “Antioxidant properties and nutritional quality assessment of berries produced in Portugal”, Proceedings of the XXVth International Conference on polyphenols, Montpellier, France, 448-449pp.
 12. Santos C, Tavares L, Pontes V, Ferreira R (2011) “Poder antioxidante dos pequenos frutos e seus efeitos benéficos para a saúde humana”, Proceedings of the III Colóquio Nacional da Produção de Pequenos Frutos, Sever do Vouga, Portugal published in “Actas Portuguesas de Horticultura” nº 18.
 13. Oliveira PB, da Fonseca LL, Tavares L, Santos CN, Sousa V & Pinto P. 2012. Amoras endémicas, qual o seu potencial agronómico e fitoquímico. IV Colóquio Nacional da Produção de Pequenos Frutos. Actas Portuguesas de Horticultura nº 20. APH. Faro, Portugal. 52-57
 14. Pinto P, Cardoso S, Pimpão R, Fortalezas S, Tavares L, Alves M, Ferreira RB, Santos CN. Ingestão diária em polifenóis proveniente de pequenos frutos. IV Colóquio Nacional da Produção de Pequenos Frutos. Actas Portuguesas de Horticultura nº 20. APH. Faro, Portugal. 182-187

Communications

Oral communications by invitation

1. Santos CN, Gaspar ME, Ferreira RB, Ricardo CP, Teixeira AR (1995) “Aumento dos níveis de glicolato oxidase em *Lemna minor* em situações de choque térmico e na presença de metais pesados”, IV Congresso Luso-Espanhol de Fisiologia Vegetal, Estoril, Portugal, from 3 to 6 October; Abstract nº 93.
2. Ferreira R, Caeiro A, Santos C, Teixeira A (1996) “The plant 26S proteasome”, 10th Congress of the Federation of European Societies of Plant Physiology (FESPP), Florence, Italy from 9 to 13 September; Abstract published in the special edition of Plant Physiol Biochem pp 336-337 U-06.
3. Caeiro A, Branco C, Santos C, Teixeira A, Ferreira R (2002) “The Ubiquitin/proteasome Pathway from *Lemna minor* Transcription of E1 and the 26S

- Proteasome During Heat Shock”, XIII Congresso Nacional de Bioquímica Lisboa, Portugal, from 5 to 7 December; Abstract CS-1.
4. Ferreira RB, Santos CN, Martins PD, Caeiro AS, Price CB, Teixeira AR (2003) "Increase in E1 protein precedes its mRNA transcript accumulation during heavy metal stress (arsenite) in *Lemna minor*" VIII Congresso Hispano-Luso de Fisiologia Vegetal, Palma de Maiorca, Spain, from 16 to 20 September.
 5. Santos CN (2007) "Search for plant phenolic compounds exhibiting antioxidant activity and neuroprotective properties in a neuronal cell model of Parkinson's disease", Small group meeting from the COST863 on small fruit production systems, Oeiras, Portugal, from 8 to 10 November.
 6. Santos C, Tavares L, Duarte D, Esteves S, Pontes V, Teixeira A, Ferreira R (2008) "Poder antioxidante dos pequenos frutos e seus efeitos benéficos para a saúde humana", III Colóquio Nacional da Produção de Pequenos Frutos, Sever do Vouga, Portugal, from 26 to 27 de June.
 7. Tavares LR, Santos CN, McDougall GJ, Stewart D, Ferreira RB (2008) "Portuguese endemic wild blackberries as an alternative source of polyphenols and antioxidant activity", COST863 WG1 + WG4 Joint Meeting Bioactive compounds in berry fruits: genetic control breeding cultivar analytical aspects and human health, Zurich, Switzerland, from 3 to 5 December.
 8. Santos C, Tavares L, Pontes V, Alves P, Ferreira R (2008) "Antioxydant capacity of portuguese endemic *Rubus* fruits in a neurodegeneration cell model", COST863 WG1 + WG4 Joint Meeting Bioactive compounds in berry fruits: genetic control breeding cultivar analytical aspects and human, Zurich, Switzerland, from 3 to 5 December.
 9. Tavares LR, Santos CN, McDougall GJ, Fortalezas S, Carrilho D, Stewart D, Ferreira RB (2009) "Phytochemical profiling of different tissues from Portuguese endemic *Rubus* species" COST863 Management Committee and Workshop on Defining needs of berry industries, Lisboa, Portugal, from 19 to 21 March.
 10. Tavares L, McDougall GJ, Stewart D., Ferreira RB, Santos CN (2010) "Neuroprotective effects of serum bioavailable metabolites from *Rubus* sp." 1st ITQB PhD Students' Meeting, Instituto de Tecnologia Química e Biológica, Oeiras, Portugal, 21-22 October.
 11. Santos CN, Tavares L, Figueira I, Alves M, Stewart D, Pimpão R, Williamson G, Ferreira RB (2011) "Plant-derived compounds and neurodegenerative diseases." EPSO Workshop, Plant Pigments and Human Health, Gerona, Spain, 24-26 May.
 12. Santos CN, Tavares L, Alves M, Macedo D, Pimpão R, Figueira I, Fortalezas S, Ferreira RB (2011) "Fitoquímicos das plantas como agentes neuroprotectores." XII Semana das Ciências Agrárias, Bragança, Portugal, 16 March.
 13. Santos CN, Tavares L, Figueira I, Alves M, Pimpão R, Macedo D, Pinto P, Ferreira RB (2011) "Pequenos frutos e seus efeitos benéficos para a saúde humana." Fórum 4 – Alimentação, Tecnologia, Qualidade, Segurança, Santarém, Portugal, 16 November.
 14. Tavares L, Figueira I, McDougall GJ, Stewart D, Ferreira RB, Santos CN (2012) "Amoras, o segredo para um envelhecimento saudável?" IV Colóquio Nacional da Produção de Pequenos Frutos, Faro, Portugal, 20-21 April.

Over 50 posters presented at scientific meetings, both national and international.

Patents

Santos CN, Ferreira RB, Tavares L, Pimpão R, Williamson G, Stewart D. Utilização de

folhas e frutos de Corema album na preparação de sumos e de outras aplicações devido às propriedades benéficas para a saúde humana resultantes da sua ingestão e do facto de alguns dos seus componentes sobreviverem, com ou sem modificação química, ao processo digestivo e/ou de absorção. INPI application nº 20121000061878 (Provisional patent application).