

## Short Curriculum Vitae

**Name:** Rebola, Nelson  
**Date of birth:** 16<sup>th</sup> September, 1979 (Portugal)  
**Nationality:** Portuguese  
**Present Position:** Junior group Leader, CNRS CR1 Researcher  
**Laboratory:** l'Institut du Cerveau et de la Moelle épinière, CNRS UMR 7225 - Inserm U 1127 - UPMC-P6 UMR S 1127.

### Academic degrees:

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2002 - Graduated in Biochemistry, University of Lisbon, Portugal.  
 2008 - PhD degree in Biology with honour and distinction, University of Coimbra, Portugal

### Education and professional curricula

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2017/present Junior Group Leader Brain and Spine Institute (ICM-Paris).  
 2012/2017 CR1 (*Chargé de recherche*, equivalent assistant professor), Unit of Dynamic Neuronal Imaging, CNRS URA 2182, Institut Pasteur (in mission from unit CNRS UMR 5297)  
 2010/2012 CR2 (*Chargé de recherche*, equivalent assistant professor), CNRS UMR 5297, Bordeaux, France  
 2008/2010 Postdoctoral fellow CNRS 5091 (EMBO fellowship), Bordeaux, France (Supervisor: Christophe Mulle)  
 2005/2008 Visiting scientist CNRS 5091 (Collaboration with Christophe Mulle Lab)  
 2003/2008 PhD student (Center for Neuroscience of Coimbra) (Supervisor: Rodrigo Cunha)  
 2002/03 Project investigator (POCTI 43663/99), Center for Neurosciences of Coimbra  
 2001/02 Student at the Center for Neurosciences of Coimbra

### Student/Research Supervision:

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2020-present Yann Zerlaut - Postdoctoral Fellow **Subject:** *Cellular correlates of brain-state modulation of sensory processing.*  
 2018-present Dhanasak Dhanasobhon - Postdoctoral Fellow **Subject:** *Role of GluN3A subunit in SST interneurons.*  
 2017-present Marcel de Brito Van Velze - PhD Student **Subject:** *Impact of NMDARs in the activity of VIP interneurons*  
 2017-present Annunziato Morabito - Postdoctoral Fellow – **Subject:** *Modulation of NMDARs by zinc*  
 2017 Louison Lallemand, Master Student - **Subject:** *Voltage imaging in single presynaptic boutons.*  
 2016 Sophia Karpenko, Master Student - **Subject:** *Presynaptic calcium dynamics in cerebellar basket cells.*  
 2012-2014 Emiliene Repak, PhD Student - **Subject:** *Optical control of NMDA receptors with a diffusible photoswitch.*  
 2014 Loic Dumas, Master Student - **Subject:** *Using FCS to estimate calcium-binding constants of calcium indicators.*  
 2010-2012 S. Bettadapura. Postdoctoral Fellow - **Subject:** *Activity dependent modulation of GluN2 subunit composition of synaptic NMDARs at mossy fiber synapses.*  
 2010 M. Vassinot, Master Student - **Subject:** *Role of GluN2A c-terminal tail in zinc dependent modulation of synaptic NMDARs.*

### Grants/Fellowships/awards

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2002 – 2007 FCT PhD fellowship  
 2008 – 2010 EMBO fellowship  
 2013 CNRS Bronze medal  
 The CNRS Bronze Medal recognizes a researcher's first work, which makes that person a specialist with talent in a particular field (source CNRS website).  
 2015 ERC starting grant (1200 keuros)  
 2018 NARSAD Young investigator award (65keuros)

2018 Fondation Plan Alzheimer, AAP 2018 (collaborator – 15keuros)  
2018 DIM ELICIT: equipment call 2018 (collaborator – 230keuros)

### Expertise

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Neurophysiology – Neuropharmacology – Synaptic transmission – Neuromodulation

Techniques: Western blot, Slice electrophysiology, Patch-clamp recordings, in vitro and in vivo two-photon imaging.

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### Topics of research

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- 1-Understand function of NMDA receptors function in the brain
- 2-Investigate the mechanism involved in the antidepressant actions of ketamine, an NMDAR antagonist.
- 3-GluN3 receptors as a new pharmacological target in the brain to treat depression and Schizophrenia – an alternative to ketamine.
- 4-Identification of cellular mechanisms involved in information processing in the brain.

### Teaching experience

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- Invited Lecturer- Master 2 module, Neuropharmacologie Moléculaire, ENS (Paris, France, 2014, 2015, 2016).
- Teaching assistant Applications of Fluorescence Microscopy (Institut Pasteur, Paris, France) (2016, 2017, 2018)
- Teaching assistant, CAJAL school “Hippocampus: from Circuits to Cognitions”, Bordeaux, France. (2016).
- Teaching assistant, “Paris Neuroscience School”, Paris, France. (2017, 2018).

### Reviewer

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Journal of Neuroscience, European Journal of Neuroscience, PLoS One, Neuron, Plos Biology, Elife, Nature Neuroscience, Molecular Psychiatry

### Invited Lectures

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- Adenosine A<sub>2A</sub> Receptors Are Essential for Long-Term Potentiation of NMDA-EPSCs at Hippocampal Mossy Fiber Synapses, Sixième Journée Synapse, Bordeaux, France, 2008.
- Control of Neurodegeneration by adenosine A<sub>2A</sub> receptors: Possible involvement of more than one mechanism, 10th Meeting of Portuguese Society for Neuroscience, Ofir, Portugal, 2007.
- Retrograde signaling at hippocampal mossy fiber synapses, 3rd annual EU Synapse meeting, Budapest, Hungary, 2011.
- Impact of presynaptic calcium dynamics in vesicle release at inhibitory and excitatory nerve terminals of the cerebellum, Copenhagen, FENS 2016.
- Function and mechanisms of synaptic diversity in the brain. Erasmus University, 2018, Rotterdam. Netherlands.
- Mechanisms of synaptic diversity in the brain. BENEFRI workshop, Bern, 2019, Switzerland.

### Early achievements track-record

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*H-index: 24 (from Web of Science) total citations – 1602*

*Total number of publications: 36*

### 8 Peer-reviewed selected publications from total of 36

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(1) **Rebola N**, Reva M, Kirizs T, Szoboszlay M, Lorincz A, Moneron G, Nusser Z, DiGregorio DA, Distinct Nanoscale Calcium Channel and Synaptic Vesicle Topographies Contribute to the Diversity of Synaptic Function. *Neuron* 2019, (in press)

- (2) Carta, M., Srikumar, S.N, Gorlewicz, A., **Rebola, N\*** and Mulle C\* Activity-dependent control of NMDA receptor subunit composition at hippocampal mossy fiber synapses. *J. Physiol* (\*-Co-last authors)
- (3) **Rebola N**, Carta M, Mulle C, Operation and plasticity of hippocampal CA3 circuits: implications for memory encoding. *Nat. Rev. Neurosci.* 2017 Apr;18(4):208-220.
- (4) Vergnano AM\*, **Rebola N\***, Savtchenko L\*, Casado M, Kieffer B, Rusakov D, Mulle C and Paoletti P, Zinc dynamics and action at excitatory synapses, *Neuron* 2014, 82(5):1101-14. \*-Co-first authors
- (5) Carta M\*, Lanore F\*, **Rebola N\***, Szabo Z, Viana Da Silva S, Lourenço J, Verraes A, Nadler A, Schultz C, Blanchet C, Mulle, C. Membrane lipids tune synaptic transmission by direct modulation of presynaptic potassium channels, *Neuron*. 2014, 81(4):787-99. \*-Co-first authors
- (6) **Rebola N**, Carta M, Lanore F, Blanchet C, Mulle C. NMDA receptor-dependent metaplasticity at hippocampal mossy fiber synapses. *Nature Neurosci.* 2011Jun.;14(6):691–3.
- (7) **Rebola N**, Luján R, Cunha RA, Mulle C. Adenosine A2A Receptors Are Essential for Long-Term Potentiation of NMDA-EPSCs at Hippocampal Mossy Fiber Synapses. *Neuron*. 2008 Jan.;57(1):121–34.
- (8) Marvin JS, Scholl B, Wilson DE, Podgorski K, Kazemipour A, Müller JA, Schoch S, Quiroz FJU, **Rebola N**, Bao H, Little JP, Tkachuk AN, Cai E, Hantman AW, Wang SS, DePiero VJ, Borghuis BG, Chapman ER, Dietrich D, DiGregorio DA, Fitzpatrick D, Looger LL. Stability, affinity, and chromatic variants of the glutamate sensor iGluSnFR. *Nat Methods*. 2018 Nov;15(11):936-939.

### Total publications :

- Rebola N**, Oliveira CR, Cunha RA. Transducing system operated by adenosine A(2A) receptors to facilitate acetylcholine release in the rat hippocampus. *European Journal of Pharmacology*. 2002Nov.1;454(1):31–8.
- Rebola N**, Coelho JE, Costenla AR, Lopes LV, Parada A, Oliveira CR, et al. Decrease of adenosine A1 receptor density and of adenosine neuromodulation in the hippocampus of kindled rats. *Eur J Neurosci*. 2003Aug.;18(4):820–8.
- Rebola N**. Enhanced Adenosine A2A Receptor Facilitation of Synaptic Transmission in the Hippocampus of Aged Rats. *Journal of Neurophysiology*. 2003Apr.17;90(2):1295–303.
- Rebola N**. Subcellular localization of adenosine A1 receptors in nerve terminals and synapses of the rat hippocampus. *Brain Research*. 2003Oct.10;987(1):49–58.
- Lopes LV, **Rebola N**, Pinheiro PC, Richardson PJ, Oliveira CR, Cunha RA. Adenosine A3 receptors are located in neurons of the rat hippocampus. *Neuroreport*. 2003Aug.26;14(12):1645–8.
- Lopes LSV, **Rebola N**, Costenla AR, Halldner L, Jacobson MA, Oliveira CR, et al. Adenosine A3 receptors in the rat hippocampus: Lack of interaction with A1 receptors. *Drug Dev. Res*. 2003May22;58(4):428–38.
- Lopes LV, Halldner L, **Rebola N**, Johansson B, Ledent C, Chen JF, et al. Binding of the prototypical adenosine A2A receptor agonist CGS 21680 to the cerebral cortex of adenosine A1 and A2A receptor knockout mice. *British Journal of Pharmacology*. 2004Mar.;141(6):1006–14.
- Rebola N**, Rodrigues RJ, Lopes LV, Richardson PJ, Oliveira CR, Cunha RA. Adenosine A1 and A2A receptors are co-expressed in pyramidal neurons and co-localized in glutamatergic nerve terminals of the rat hippocampus. *Neuroscience*. 2005;133(1):79–83.
- Tebano MT, Martire A, **Rebola N**, Peponi R, Domenici MR, Gro MC, et al. Adenosine A2A receptors and metabotropic glutamate 5 receptors are co-localized and functionally interact in the hippocampus: a possible key mechanism in the modulation of N-methyl-D-aspartate effects. *Journal of Neurochemistry*. 2005Nov.;95(4):1188–200.
- Rodrigues RJ, Alfaro TM, **Rebola N**, Oliveira CR, Cunha RA. Co-localization and functional interaction between adenosine A2A and metabotropic group 5 receptors in glutamatergic nerve terminals of the rat striatum. *Journal of Neurochemistry*. 2005Feb.;92(3):433–41.
- Rebola N**, CANAS P, OLIVEIRA C, CUNHA R. Different synaptic and subsynaptic localization of adenosine A receptors in the hippocampus and striatum of the rat. *Neuroscience*. 2005;132(4):893–903.
- Rebola N**, Porciúncula LO, Lopes LV, Oliveira CR, Soares-da-Silva P, Cunha RA. Long-term effect of convulsive behavior on the density of adenosine A1 and A2A receptors in the rat cerebral cortex. *Epilepsia*. 2005;46 Suppl 5:159–65.
- PINHEIRO P, RODRIGUES R, **Rebola N**, XAPELLI S, OLIVEIRA C, MALVA J. Presynaptic kainate receptors are localized close to release sites in rat hippocampal synapses. *Neurochemistry International*. 2005Oct.;47(5):309–16.
- Rebola N**, Rodrigues RJ, Oliveira CR, Cunha RA. Different roles of adenosine A1, A2A and A3 receptors in controlling kainate-induced toxicity in cortical cultured neurons. *Neurochemistry International*. 2005Oct.;47(5):317–25.
- COELHO J, **Rebola N**, FRAGATA I, RIBEIRO J, DEMENDONCA A, CUNHA R, et al. Hypoxia-induced desensitization and internalization of adenosine A1 receptors in the rat hippocampus. *Neuroscience*. 2006;138(4):1195–203.
- Ciruela F, Casadó V, Rodrigues RJ, Luján R, Burgueño J, Canals M, et al. Presynaptic control of striatal glutamatergic neurotransmission by adenosine A1-A2A receptor heteromers. *Journal of Neuroscience*. 2006Feb.15;26(7):2080–7.
- Pereira DB, **Rebola N**, Rodrigues RJ, Cunha RA, Carvalho AP, Duarte CB. TrkB receptors modulation of glutamate release is limited to a subset of nerve terminals in the adult rat hippocampus. *J. Neurosci. Res*. 2006;83(5):832–44.
- Degroot A, Kofalvi A, Wade MR, Davis RJ, Rodrigues RJ, **Rebola N**, et al. CB1 Receptor Antagonism Increases Hippocampal Acetylcholine Release: Site and Mechanism of Action. *Molecular Pharmacology*. 2006Jul.17;70(4):1236–45.
- KAROVIC O, TONAZZINI I, **Rebola N**, EDSTROM E, LOVDAHL C, FREDHOLM B, et al. Toxic effects of cobalt in primary cultures of mouse astrocytes—Similarities with hypoxia and role of HIF-1 $\alpha$ . *Biochemical Pharmacology*. 2007Mar.1;73(5):694–708.
- Rebola N**, Sachidhanandam S, Perrais D, Cunha RA, Mulle C. Short-Term Plasticity of Kainate Receptor-Mediated EPSCs Induced by NMDA Receptors at Hippocampal Mossy Fiber Synapses. *Journal of Neuroscience*. 2007Apr.11;27(15):3987–93.
- Kofalvi A, Pereira MF, **Rebola N**, Rodrigues RJ, Oliveira CR, Cunha RA. Anandamide and NADA bi-directionally modulate presynaptic Ca<sup>2+</sup> levels and transmitter release in the hippocampus. *British Journal of Pharmacology*. 2009Jan.29;151(4):551–63.
- Rebola N**, Luján R, Cunha RA, Mulle C. Adenosine A2A Receptors Are Essential for Long-Term Potentiation of NMDA-EPSCs at Hippocampal Mossy Fiber Synapses. *Neuron*. 2008Jan.;57(1):121–34.
- Shen HY, Coelho JE, Ohtsuka N, Canas PM, Day YJ, Huang QY, et al. A Critical Role of the Adenosine A2A Receptor in Extrastriatal Neurons in Modulating Psychomotor Activity as Revealed by Opposite Phenotypes of Striatum and Forebrain A2A Receptor Knock-Outs. *Journal of*

- Neuroscience. 2008Mar.19;28(12):2970–5.
24. Yu L, Shen H-Y, Coelho JE, Araújo IM, Huang Q-Y, Day Y-J, et al. Adenosine A<sub>2A</sub> receptor antagonists exert motor and neuroprotective effects by distinct cellular mechanisms. *Ann Neurol*. 2008Mar.;63(3):338–46.
  25. Lanore F, **Rebola N**, Carta M. Spike-Timing-Dependent Plasticity Induces Presynaptic Changes at Immature Hippocampal Mossy Fiber Synapses. *Journal of Neuroscience*. 2009Jul.1;29(26):8299–301.
  26. Thorsen TS, Madsen KL, **Rebola N**, Rathje M, Anggono V, Bach A, et al. Identification of a small-molecule inhibitor of the PICK1 PDZ domain that inhibits hippocampal LTP and LTD. *Proceedings of the National Academy of Sciences*. 2010Jan.5;107(1):413–8.
  27. **Rebola N**, Srikumar BN, Mulle C. Activity-dependent synaptic plasticity of NMDA receptors. *The Journal of Physiology*. 2010Jan.3;588(1):93–9.
  28. **Rebola N**, Simões AP, Canas PM, Tomé AR, Andrade GM, Barry CE, et al. Adenosine A<sub>2A</sub> receptors control neuroinflammation and consequent hippocampal neuronal dysfunction. *Journal of Neurochemistry*. 2011Feb.9;117(1):100–11.
  29. **Rebola N**, Carta M, Lanore F, Blanchet C, Mulle C. NMDA receptor-dependent metaplasticity at hippocampal mossy fiber synapses. *Nature Neurosci*. 2011; 14(6):691–3.
  30. Carta M\*, Lanore F\*, **Rebola N\***, Szabo Z, Viana Da Silva S, Lourenço J, Verraes A, Nadler A, Schultz C, Blanchet C, Mulle, C. Membrane lipids tune synaptic transmission by direct modulation of presynaptic potassium channels. *Neuron*. 2014; 81(4):787-99. \*-Co-first authors
  31. Lourenço J, Pacioni S, **Rebola N**, van Woerden GM, Marinelli S, DiGregorio D, Bacci A. Non-associative potentiation of perisomatic inhibition alters the temporal coding of neocortical layer 5 pyramidal neurons. *PLoS Biol*. 2014 ;12(7):e1001903.
  32. Vergnano AM\*, **Rebola N\***, Savtchenko L\*, Casado M, Kieffer B, Rusakov D, Mulle C and Paoletti P, Zinc dynamics and action at excitatory synapses. *Neuron* 2014 ;82(5):1101-14.\*-shared authorship. \*-Co-first authors
  33. Laprell L, Repak E, Franckevicius V, Hartrampf F, Terhag J, Hollmann M, Sumser M, **Rebola N**, DiGregorio DA, Trauner D. Optical control of NMDA receptors with a diffusible photoswitch. *Nat Commun*. 2015; 6:8076.
  34. **Rebola N**, Carta M, Mulle C, Operation and plasticity of hippocampal CA3 circuits: implications for memory encoding. *Nat. Rev. Neurosci*. 2017 Apr;18(4):208-220.
  35. Agís-Balboa RC, Pinheiro PS, **Rebola N**, Kerimoglu C, Benito E, Gertig M, Bahari-Javan S, Jain G, Burkhardt S, Delalle I, Jatzko A, Dettnerhofer M, Zunszain PA, Schmitt A, Falkai P, Pape JC, Binder EB, Mulle C, Fischer A, Sananbenesi F. Formin 2 links neuropsychiatric phenotypes at young age to an increased risk for dementia *EMBO J*. 2017 Oct 2;36(19):2815-2828. doi: 10.15252/embj.201796821.
  36. Carta, M., Srikumar, S.N, Gorlewicz, A., **Rebola, N\*** and Mulle C\* Activity-dependent control of NMDA receptor subunit composition at hippocampal mossy fiber synapses. *J. Physiol* (in press) (\*-Co-last authors)
  37. Marvin JS, Scholl B, Wilson DE, Podgorski K, Kazemipour A, Müller JA, Schoch S, Quiroz FJU, **Rebola N**, Bao H, Little JP, Tkachuk AN, Cai E, Hantman AW, Wang SS, DePiero VJ, Borghuis BG, Chapman ER, Dietrich D, DiGregorio DA, Fitzpatrick D, Looger LL. Stability, affinity, and chromatic variants of the glutamate sensor iGluSnFR. *Nat Methods*. 2018 Nov;15(11):936-939.
  38. **Rebola N\***, Reva M\*, Kirizis T, Szoboszlay M, Lorincz A, Moneron G, Nusser Z, DiGregorio DA, Distinct Nanoscale Calcium Channel and Synaptic Vesicle Topographies Contribute to the Diversity of Synaptic Function. *Neuron* 2019, (in press)