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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2014

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**Nombre:** ANDERO GALI, RAUL  
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### Título:

Translational mechanisms of stress and fear

### Resumen de la Memoria:

I graduated in Psychology at the Universidad Autónoma de Barcelona (UAB) in 2003. As graduate student at Dr. Coll-Andreu lab (UAB) I studied memory using deep brain stimulation in rats. We found that electric stimulation of the anterior part of the pedunclopontine tegmental nucleus before training in an active avoidance task enhances memory (Andero et al., 2007). Title of the DEA dissertation: Effects of electrical stimulation in the pedunclopontine tegmental nucleus in two-way active avoidance: influence of time and electrode site implantation (2005). Then I moved to the Dr. Armario & Dr. Nadal lab (UAB), where my collaborations resulted in two studies. In the first one, we reported how two different PTSD-like models, immobilization to a wooden board (IMO) or exposure to cat odor, elicit a completely different pattern of the stress hormones ACTH and Corticosterone. Moreover, the levels of these hormones are independent of the long-term anxiety that rats present after exposure to these PTSD-like models (Muñoz-Abellán et al., 2008). In the second study, we described how a repeated dose of amphetamine in rats enhanced locomotor activity whereas it decreased the release of ACTH and Corticosterone. This finding suggests a dissociation of locomotor and stress responses induced by amphetamine (Gagliano et al., 2009). For my doctoral dissertation, I studied memory and stress dysregulation in rodents as models of Posttraumatic Stress Disorder (PTSD). Title: Post-traumatic stress models in rodents: pharmacological activation of TrkB receptors reverses learning and memory deficits. We showed how the first identified small molecule TrkB agonist, 7,8-dihydroxyflavone (7,8-DHF), prevents the appearance of PTSD-like symptoms when given few hours after a traumatic stress exposure in rats (Andero et al., 2012). I visited 2 times, spending 8 months in total, the prestigious Dr. Ressler's lab, funded by the Howard Hughes Medical Institute at Emory University (USA). In Dr. Ressler's lab I learned techniques in behavior and molecular biology. 2 manuscripts were published from the work during these visits. In the first one, we discovered that 7,8-DHF given systemically phosphorylated the TrkB receptor in the amygdala, a key area in fear processing. Fear is a key component of PTSD because individuals who suffer from this disorder present enhanced consolidation of fear memories. Moreover, 7,8-DHF rescued a fear extinction deficit in mice that had been previously exposed to IMO (Andero et al., 2011). In the second study we found that another TrkB agonist, Deoxygedunin, has neuroprotective, anti-depressant and learning enhancement effects. Since 2010, I have been a Postdoc in the Ressler lab where I have received training in translational neuroscience combining studies in humans with PTSD and animal models. I have also written about the molecular mechanisms of fear (review by Andero et al., 2012, and a book chapter Andero et al., 2014). Moreover, we have discovered that the Oprl1 gene in the amygdala is related to dysregulated fear in a PTSD-like model. In humans, OPR1 is associated with PTSD symptoms and activation of the Oprl1 receptor may have implications for prevention of PTSD (Andero et al., 2013). I have also recently reported that a Neurokinin 3 receptor antagonist may be therapeutic for treating fear disorders (Andero et al., 2014).

### Resumen del Currículum Vitae:

After obtaining my BS in Psychology in 2003 by the Universidad Autónoma de Barcelona (UAB), I joined Dr. Coll-Andreu's lab (UAB, School of Psychology) to study memory using deep brain stimulation in rats (Andero et al., 2007 *Neurobiology of Learning and Memory*, IF 3.443). I also was Professor Tutor at the Universidad de Educación a Distancia (UNED) at the School of Psychology, where I taught theory classes of Psychobiology (2004-2005). After obtaining my Advanced Studies Diploma (DEA) (2005), I was awarded with a FPI fellowship (2006-2010) at the lab of Dr. Armario (School of Biosciences) & Dr. Nadal (School of Psychology) at the UAB (to study memory and stress dysregulation in rodents as models of Posttraumatic Stress Disorder (PTSD) (Andero et al., 2012 *Hippocampus*, IF 5.492). In collaboration with Panlab S.L., I developed software and hardware for analyzing behavior in rodents (2007). I received a FPI long-term stay fellowship (2008) to visit the prestigious lab of Dr. Ressler's lab at Emory University which is funded by the National Institutes of Health (NIH) and Howard Hughes Medical Institute (USA). In this lab, I learned molecular biology and behavior in PTSD models (Andero et al., 2011 «*American Journal of Psychiatry*», IF 12.5). In 2010, after obtaining my PhD and receiving the Doctoral Extraordinary Prize by the UAB, I joined Dr. Ressler's lab as Postdoctoral Fellow where I have received further training in translational neuroscience by combining studies in humans with PTSD and animal models (review by Andero et al., 2012 *Genes, Brain and Behavior*, IF 3.6; Andero et al., 2013 «*Science Translational Medicine*», IF 14.4, recommended in Faculty1000; book chapter Andero et al., 2014 *PMBTS Book series*). Moreover, I am corresponding author of Andero et al., 2014 «*Neuron*», IF 16. The average impact factor of my publications is 8 and all of them are in the first quartile, including the ones I am co-author: *Neuron*, IF 16; *PLoS One*, IF 4.4; *Psychoneuroendocrinology*, IF 3.8; *Psychopharmacology*, IF 4.1; *Hormones and Behavior*, IF 4.5. I have presented 20 posters in international meetings, and I have been invited to 9 talks including the world-class meetings Society for Neuroscience (SfN), Society for Biological Psychiatry (SOBP), International Narcotics Research Conference (INRC) and Anxiety and Depression Conference. I have received postdoctoral travel awards by the Federation of European Neuroscience Societies, INRC, SOBP and Wisconsin Symposium on Emotion. I have also received the NCDEU New Investigator Award by the American Society of Clinical



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Psychopharmacology and the Outstanding Postdoc Award by Emory University. I am the only co-investigator of a R21 grant, NIH-NIMH (USA) and Principal Investigator of the NARSAD Young Investigator Grant. I also served as co-chair of the Amygdala Social at SfN 2011-2013. My scientific publications have been commented in news media of more than 25 countries including National Geographic, Forbes, The Scientist Magazine, Newsweek (USA), El Pais (Spain). I have also conducted interviews in Los Angeles Times, Scientific American, US News (USA), ABC and Quo (Spain), El Economista (Mexico), and I have recorded a podcast for Jackson Labs (USA). I am joining Harvard Medical School in June 2015 as Research Associate.



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### Título:

Neurodevelopment bases of higher cognitive functions

### Resumen de la Memoria:

In my research I used behavioral, functional and structural Magnetic Resonance Imaging (MRI) techniques to investigate the neural bases and the development of higher cognitive functions, including memory, attention and language-related processes. This line of research lies in the field of Developmental Cognitive Neuroscience.

More specifically, my research activity can be divided in four areas of interest: 1) neurodevelopmental correlates of true and false memory formation, 2) developmental changes associated with mnemonic control operations during episodic memory retrieval and their neural basis, 3) neuroimaging and behavioral studies with adults on spatial attention and visual consciousness and with children on the development of attention networks, and 4) research on the neural correlates of reading and language production processes in typical and atypical populations.

### Resumen del Currículum Vitae:

My research has been focused on using behavioral, functional and structural Magnetic Resonance Imaging (MRI) techniques to investigate the neural bases of higher cognitive functions in adults, as well as the development of these functions from childhood to adulthood. This line of research lies in the field of Developmental Cognitive Neuroscience, and it requires intensive training and specialization in MRI methods and the use of different neuroscientific tools and indexes. Pediatric neuroimaging research also requires an extensive knowledge of the development of the human brain and the problems and potential solutions to correct head motion during and after data acquisition, as well as additional time to collect and analyze data from several developmental groups and large samples of participants.

During my PhD (awarded with the Extraordinary Dissertation Award) and after it, I have had the opportunity to work in the advanced use of MRI for a total of 6 years at some internationally renowned institutes in Cognitive Neuroscience, having postdoctoral positions at the Center for Mind and Brain at the University of California, Davis (Research Directors: Distinguished Professor Gail S. Goodman and Professors Simona Ghetti and Silvia Bunge); and, at the Helen Wills Neuroscience Institute at the University of California, Berkeley (Research Director: Professor Silvia A. Bunge). Additionally, I was awarded a grant from the American Psychological Association (APA) to receive advanced training in fMRI methods and neuroimaging analytical tools at the Athinoula A. Martinos Center of the Massachusetts Institute of Technology (MIT).

I have participated as a collaborator, Co-PI, and PI in multiple research projects funded by national (e.g., FIS, MICIN, MINECO) and international agencies (e.g., European Commission, ERC, NSF). And, I have been awarded predoctoral and postdoctoral fellowships from the Department of Universities, Education, and Investigation of the Basque Government and the Spanish Ministry of Education and Science.

In my current position at the BCBL, I continue conducting MRI studies in Developmental Cognitive Neuroscience and also with groups of young adults examining memory and language-related functions, such as reading, comprehension and language production in typical and atypical populations (e.g., readers with dyslexia).



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**Nombre:** TAJADURA JIMENEZ, ANA  
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### Título:

Shaping body-representation by auditory augmented reality for emotional and physical well-being

### Resumen de la Memoria:

Our body demarcates the physical boundaries between our own embodied existence and the external world. Through our senses we receive information that leads to unified and coherent representations of one's own body and the events around it. My research aims to uncover the cognitive and emotional processes behind the formation of these representations, which are central to act upon the environment but also to body-image and self-esteem. I am particularly interested in the fundamental but largely unexplored role of auditory signals in these processes. Along this line, three independent but interconnected avenues of research have captured the attention of my investigations.

Embodied perspective to study auditory-induced emotion and multisensory integration: By adopting this novel perspective, my investigations have revealed that the spatial positioning of a sound source in relation to one's body (e.g. behind, close, approaching) is critical to the intensity of the emotional responses it can induce (Tjadura-Jimenez et al, 2010, Emotion). I also helped solving a long debate regarding whether auditory-somatosensory integration is spatially modulated, by showing that this modulation depends on the body surface stimulated or the spectra of the acoustic stimuli (Tjadura-Jimenez et al, 2009, Neuropsychol).

Body-sensory feedback to change the mental representation of one's own body: My research has provided an in-depth understanding of the malleability of face-representations by introducing important methodological advances in measuring changes in self-recognition (e.g. fMRI, electrophysiology). A major breakthrough was our discovery of the interaction between awareness of the body from within (i.e. interoceptive awareness) and awareness of the body from the outside, which led to a more integrative approach on body-awareness (Tsakiris et al, 2011, Proc Biol Sci). A second major breakthrough was my discovery that sound can change body-representations, a relevant finding as previously body-representation was thought to be only informed by visual, proprioceptive and tactile sensory inputs (Tjadura-Jimenez et al, 2012, Curr Biol). This work marked also an advance in my research career as it set the basis to get funded for three years and allowed my establishment as an independent researcher.

Sound and body-representation to alter motor behaviour and emotion: My research is pioneer in using sound to alter body-representation and in exploring the impact of these alterations in behavior and emotion (Tjadura-Jimenez et al, 2015, CHI). My multidisciplinary expertise, which draws together cognitive neuroscience, applied acoustics and human-computer interaction, places me in a unique position to conduct this research through the use of technology. This research has repercussions for the design of therapies and technologies to enhance body-representations. With the increasing social concern about our bodies, my investigation could help to keep us physically and mentally healthy, thus making a socioeconomic impact.

My research career is summarized in 42 publications (H-index=11), vast participation in science communication events, my world-wide collaboration network and my ability to attract funding bodies and public media. The recognition to these achievements has allowed me to launch my career as an independent group leader within a top university.

### Resumen del Currículum Vitae:

I received training in human-computer interaction (HCI), cognitive neuroscience and acoustics from world-leading labs in these fields. I studied Telecom Engineering at Universidad Politécnica de Madrid, obtained both an International MSc in DigiCom Systems and Technology (2003) and a PhD in Applied Acoustics (2008) at Chalmers University of Technology (Sweden). During my PhD period I benefited from the dual background of my supervisor, Prof Västfjäll, in cognitive psychology and in applied acoustics. I further strengthened my background in multisensory perception and experimental psychology by spending 7 months with Dr Soto-Faraco at Universitat de Barcelona and 3 months with Dr Kitagawa at NTT Laboratories (Japan), a collaboration that still continues. From 2009 I was a post-doctoral researcher at Prof. Tsakiris' Lab of Action and Body at Royal Holloway, University of London. In 2012 I secured funding from the ESRC Future Research Leader scheme and moved to University College London (UCL) to work as a principal investigator (PI) of the project 'The Hearing Body' (2012-2015, 215k€).

My track record proves my competence to perform high quality research, to successfully collaborate with other researchers, to develop and lead independent research and to attract funding. With an H-index of 11 and 411 citations in the scientific literature, my research has



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led to 42 publications, including 19 first-authored papers in peer-reviewed journals and conferences and 3 book chapters. 15 out of my 26 papers in peer-reviewed journals are in the top Q1 quartile of their categories. I have presented my work in the major conferences in my research fields (e.g. CHI, 23% acceptance rate) and given 28 talks (12 invited). I have also organized seminars, workshops and symposiums and actively participated in numerous science communication, public engagement and knowledge transfer/exchange activities. I have been an active researcher in 12 national/international projects in the areas of virtual reality, body-representation and chronic pain. Being multidisciplinary, my research has important implications both for basic science and for novel health applications. I have been project PI twice (ESRC 215k£; JSPS ~106JPY) and co-PI twice more (BIAL 46k€; Volkswagen 90k€). At UCL, I am currently leading a small team of researchers working in The Hearing Body project. I have taught/supervised undergraduate and MSc projects (4 completed); the most recent MSc project obtained the highest mark and the best project prize in my institution. My extensive current research network is international and interdisciplinary. I am a regular visiting researcher at NTT laboratories (Japan) and also collaborate with world-wide research leaders in HCI, acoustics, cognitive neuroscience, experimental/clinical psychology, virtual reality or philosophy. I am a referee for over 15 scientific journals, member of the Editorial Board of 1 journal, referee for 8 scientific conferences, grant reviewer for the ESRC funding agency and member of the Experimental Psychology Society. I have acted as an examiner for a PhD dissertation (IRCAM, France, Dec 2014). My work has attracted public interest as it has been featured in the public media world-wide, including TV and radio programs and various magazines and journals. A highlight is the recent 4-page article in New Scientist on my Hearing Body project.



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### Título:

Stress and social behaviour: neural circuits at the base of resilience and vulnerability to psychopathology.

### Resumen de la Memoria:

My general interest is to understand how social behaviour connects to stress and psychopathology, with a special focus on the effects of stress on cooperative behaviour and resilience to psychopathology. I am particularly interested on the study of the connections between prefrontal cortex, amygdala and ventral striatum, as the critical neural circuit on the basis of the interaction between social behaviour and stress-related pathologies.

I have had always a passionate interest for the understanding of the neural basis of behaviour. During these years I have acquired a strong background in the field of stress and neural basis of psychopathology (from a behavioural neuroscience, individual differences, neurobiology, genetic and epigenetic point of view). After my first postdoctoral period, I felt that the approach we were using during these years was not satisfactory to me. I felt that we would not be able to answer the important questions and make key contributions in explaining the aetiology of psychopathology, if we did not change the current state of approaches, and started to study these processes at the circuits level and using more sophisticated ways of measuring complex behaviours. In this sense, I decided to join the laboratory of Dr. Moita, at the Champalimaud Centre for the Unknown (Lisbon, Portugal) four years ago as a postdoctoral fellow, a newly created institution which focuses on the study of Behaviour and Neural Circuits, and counts with internationally recognised experts on Systems Neuroscience. I feel that now I have the technical tools, mindset, dedication, and support from my colleagues to start an independent and innovative research program.

I plan to study cooperative behaviours in animals models that will allow specific manipulations at the level of behaviour and neural circuits, and explore the modulation of cooperation by stress, which I believe is of particular relevance to anxiety and depression-related disorders in humans. Cooperation has been started to be experimentally demonstrated in the last years in human and non-human animals, but we know very little about its neural mechanisms. I want to understand how the decision making to cooperate with a conspecific is done by the brain at the circuit level. I have recently developed a new behavioural paradigm that, for the first time, allowed the study of prosocial behaviour in a food-foraging task in rats, in a highly quantifiable manner, and to disentangle the motivations that drive this type of social decision making. In my opinion, this model is very heuristic and will allow me in the future to continue to disentangle the key modulators of cooperative behaviour, with a special interest on stress, and its neural circuits.

How stress modulates social behaviour has been surprisingly largely overlooked. However, stress effects on social behaviour could have major consequences on society, with direct implications on individuals' general and mental health. On the other hand, even though cooperative behaviour is of paramount importance in social species, very little is known about its modulation by stress. Hence, my main motivation is to establish a research line that will enable the systematic study of the impact of stress on cooperation in a model system that will allow the analysis and manipulation of the neural mechanisms underlying this process.

### Resumen del Currículum Vitae:

15 publications, 605 citations, H-index 15

Since I obtained my Degree in Psychology, my main goal has been to pursue a career that allows me to make key contributions to unravel the biological correlates of psychopathology. The results of my previous scientific contributions can be explained in three main aspects:

#### INDIVIDUAL DIFFERENCES OF ENDOCRINE RESPONSE TO STRESS

The primary question I pursued during my PhD in the laboratory of Dr. Antonio Armario and Roser Nadal (UAB, Spain) focused on studying neurobiological markers that could predict differential sensibility to stress. The finding of very strong differences in the vulnerability of individuals to stress [1-10] led me to become extremely interested in the neurobiological substrates underlying such individual differences, research line that I developed independently during my postdoctoral training.

#### STRESS DURING CRITICAL PERIODS AND VULNERABILITY TO PSYCHOPATHOLOGY

During my postdoctoral period in the laboratory of Dr. Carmen Sandi (EPFL, Switzerland), we developed a new animal model of vulnerability to psychopathology, focusing on the long term effects of stress during juvenility. Peripuberty-stressed animals displayed



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increased anxiety, depression-like symptoms and aggressive behaviours during adulthood. We described the neurobiological alterations underlying this phenotype and demonstrated, for the first time, that they were explained by epigenetic changes on the MAOA gene [11]. Moreover, these effects were transmitted to future generations [12], and related to changes in plasticity-related molecules [13]. Our findings highlighted the relevance of stress during juvenility in the development of violence, and provided new insights on its neural basis. During this period, I widen my scope of research to Psychiatric Neuroscience, and learn different techniques that provided me with a very valuable multidisciplinary approach. I was awarded with two different Young Investigator Awards: SSN-IBRO (2006) and Roche Research Foundation (2007), which have recognised the value of my scientific carrier. My project was also awarded during the 8th World Congress on Neurohypophysial Hormones (Japan, 2009).

### COOPERATION AND RESILIENCE TO PSYCHOPATHOLOGY

Until this point, my entire career focused on the negative effects of stress at different critical periods on the development of psychopathology. Although I am acutely aware of the importance of this kind of research, I wanted to expand my scope and try to identify the elements that make individuals more resilient to the adverse effects of stress. I decided to start my own research domain, on how social behaviours (cooperation) might help individuals to cope with stress. In this sense, I decided to join the laboratory of Dr. Moita (Champalimaud Foundation, Portugal), one of the pioneers in the study of cooperative behaviour using game-theory in rats.

During this time, I have developed a new behavioural paradigm to study prosocial behaviour in rats. We have shown that rats display clear prosocial behaviour, providing access to food to conspecifics, and identified the key behavioural mechanisms. This work is under review in Current Biology [15], and was awarded as Best poster in the ♦Brain conference: Controlling neurons, circuits and behaviour♦ (Denmark, 2014), and as Best talk in the ♦Christmas meeting at Instituto de Neurociencias de Alicante♦ (Spain, 2014).