Name	LUCIA PRIETO-GODINO
Position	Group Leader (1st 6)
Year joined *(Crick or founder institute)*	2018

Career History

2001 – 2006: Universidad Autonoma de Madrid, Spain. BSc. in Biological Sciences (BSc. was five years long, overall mark: 3.8 out of 4. Four is given in each subject to the top 10% of the class)
2005 – 2006: BSc - Lund University, Sweden. ERASMUS student
2004 – 2005: BSc - Universidad Complutense de Madrid, Spain. INTERBIO student
2007: Training - Woods Hole MBL, USA. Neural Systems and Behaviour school
2006– 2011: PhD - University of Cambridge, UK.
2011: University of Cambridge, UK. St. John's College Postdoctoral Researcher
2012– 2017: University of Lausanne, CIG, Switzerland. Postdoctoral
2012 – present: TReND in Africa, www.TReNDinAfrica.org. Founding Director
2018 – present: The Francis Crick Institute, London, UK. Group Leader.

Major Awards, Honours and Prizes

2007 Excellence Extraordinary Price for BSc in Biology, Spain.
2015 Cambridge University Technology and Enterprise Club 3D-printing innovation award (co-recipient), UK.
2016 NEB Passion in Science award. Humanitarian Duty category, US.
2017 Winner of "Tomorrow's PIs" competition (jury award). LS2, CH.
2017 Winner of "Tomorrow's PIs" competition (public award). LS2, CH.
2017 FENS EJN Young Investigator Prize 2018, Germany.
2017 Prize of the Faculty of Biology and Medicine of the University of Lausanne, CH.
2018 L'Oreal-UNESCO For women in science, UK & Ireland.
2018 Winner of the Woman of the Future Awards Science category, UK.
2018 FENS Kavli Network of Excellence. Elected Scholar.

Membership of external committees, editorial boards, review panels, SABs etc

2011- present Selection committee for TReND in Africa scholarships.
2012 - 2017 External reviewer, CrawFly Scholarship Program at Cornell University.
2018 – present Ad-hoc reviewer for: Wellcome Trust (UK), French National Research Agency (France), BBSRC (UK),DFG (Germany), Leverhume Trust (UK).
2020 Selection committee for the FENS-Kavli Network of Excellence.

Lab Name	***Neural Circuits and Evolution Laboratory***

Research programme and achievements

The goal of the lab is to understand how evolution sculpts nervous systems, giving rise to novel behaviours. Studying the evolutionary forces imposed on neural circuits can provide us with important insights on how brains work and what goes wrong in diseases. We study these questions using a multidisciplinary approach and employing as a model the olfactory systems of several fly species, some of which are pests or contribute to the spread of diseases.

The main achievements since 2015 are the following:

- We discovered that neurons have a mechanism to selectively read through stop codons (1). This finding had two major implications. Firstly, pseudogenes thought to be non-functional can generate fully functional proteins: this shook the olfactory field and made colleagues working on other systems revisit some of their prior findings. Secondly, we uncovered a novel mechanism employed by neurons to generate increased proteomic diversity through the generation of alternative terminal extensions. Currently in the lab we are investigating the molecular mechanisms of neuron-specific readthrough, their role in healthy neuronal function, and its conservation in humans.
- We showed that a single amino acid change is sufficient to evolve the sensitivity of an olfactory receptor towards an ecologically key odour (2). This brought new insights into the molecular mechanisms by which olfactory receptors recognise their ligands. We are following up on these findings by using these receptors as a platform for discovery of the molecular evolutionary mechanisms underlaying the evolution of sensory receptors. Furthermore, this knowledge will be applicable to the rational design of molecules specific to insects' olfactory receptors for pest and vector control.
- We investigated the basis of neuronal number expansions during evolution, demonstrating that both cis- and trans- acting mutations underlie the evolutionary expansion of a sensory population (2). We also identified the regulation of programmed cell death during development as an important mechanism in the evolution of new neural pathways (3).
- To democratise the access to scientific equipment, and promote science reproducibility, we have developed open hardware tools for science, coining the term Open Labware. This includes the co-development of a custom ultra-fast volumetric two-photon microscope at the Crick to perform optogenetically guided circuit tracing. We have carried these activities hand in hand with educational programmes on Open Science in Africa as part of the non-profit organisation I co-founded.
- Our work, together with that of others has shown that olfactory guided behaviours can evolve through changes in the periphery, at the level of olfactory sensory neurons (1,2,3). In addition, behavioural diversity can evolve through modification in how sensory information is processed in the brain, but we know much less about how this happens. A strong current focus of the lab is to investigate how central neural circuits evolve by combining behavioural studies with two photon imaging, electron-microscopy based connectomics, and single cell transcriptomics.
- We have found that evolutionary relatives of the lab model *D. melanogaster* display species-specific behaviours towards odour sources. This is associated with changes their olfactory sensory neuron ensemble, and how these represent the chemical environment. Furthermore, by performing comparative connectomics between *D. melanogaster* and *D. erecta* larvae, we found differences in how their central olfactory processing neurons are interconnected, and by using transcriptomics we are investigating the genetic bases of these changes.

In the future we will build upon our previous discoveries and tool development to address the following main questions. 1) How do central neural circuits evolve? This question will be guided by our recent connectomics results and our unique comparative EM dataset. It will also rely on our establishment of genetic tools across different fly species within the Crick, and our technical capacity to combine fast two-photon volumetric imaging with optogenetic stimulation. 2) What are the functions and mechanisms of neuronal-specific stop codon readthrough? This will build on our previous findings, and novel collaborations that we have made within the Crick. 3) How do insect diseases vectors evolve their olfactory system, and how can we use this knowledge to control them? We have recently established a tsetse fly (vectors of sleeping sickness) facility at the Crick. We have discovered intriguing patterns in the evolution of their olfactory receptor repertoires, and we are investigating how these affect their biology and the diseases vectorial capacity. In addition, we will continue to develop open tools for science, and continue to collaborate with African institutions to make science a truly global endeavour.

Research outputs

Prieto-Godino LL, Rytz R., Bargeton B., Abuin L., Arguello JR, Dal Peraro, M, and Benton, R. (2016) *Olfactory receptor pseudo-pseudogenes*. Nature 539, 93 - 97. DOI: 10.1038/nature19824.
We found that an olfactory receptor pseudogene in *D. sechellia* is functional via readthrough of its premature stop codon. We demonstrated that such functional pseudogenes are common among olfactory receptors in *D. melanogaster*, and that this stop codon readthrough is neuron-specific. This paper had a big impact, making other researchers re-consider whether genes of interest annotated as pseudogenes could be functional.

Prieto-Godino LL, Rytz R, Cruchet S, Bargeton B, Abuin L, Silbering AF, Ruta V, Dal Peraro M, and Benton R. (2017) *Evolution of acid-sensing olfactory circuits in drosophilids*. Neuron 93, 3: 661 - 676. DOI: 10.1016/j.neuron.2016.12.024.
We examined the acid-sensing pathways across two generalists and one specialist *Drosophila* species with divergent odour-guided behaviours. We identified a divergent olfactory pathway in the specialist that responds strongly to an ecologically relevant odour. We discovered that a single amino acid change in a receptor was responsible for the novel odour sensitivity.

Prieto-Godino LL, Silbering AF, Khallaf MA, Cruchet S, Bojkowska K, Pradervand S, Hansson BS, Knaden M and Benton R. (2020) *Functional integration of "undead" neurons in the olfactory system*. Science Advances 6(11):eaaz7238 DOI: 10.1126/sciadv.aaz7238
Blocking programmed cell death in olfactory sensory neuron precursors in *D. melanogaster* makes new functional neurons. We demonstrated the potential of alterations in programmed cell death to evolve neuronal diversity. This process contributes to evolutionary differences across fly species and between flies and mosquitoes.

Zimmermann MJY, Chagas AM, Bartel P, Pop S, Prieto Godino LL, Baden T. (2020) *LED Zappelin': An open source LED controller for arbitrary spectrum visual*

***stimulation and optogenetics during 2-photon imaging*. HardwareX 8 E00127. DOI: 10.1016/j.ohx.2020.e00127**
We developed an Open Hardware LED controlled for time-synchronising optogenetic stimulation with two-photon line scans. This helps ameliorate bleed-through of the stimulation light into the recorded data.

Tom Baden, Mahmoud Bukar Maina, Andre Maia Chagas, Yunusa Garba Mohammed, Thomas O. Auer, Ana Silbering, Lukas von Tobel, Marie Pertin, Renee Hartig, Jelena Aleksic, Ibukun Akinrinade, Mosab A. Awadelkareem, Artemis Koumoundourou, Aled Jones, Fabiana Arieti, Andrew Beale, Daniel Munch, Samyra Cury Salek, Sadiq Yusuf and Lucia L. Prieto-Godino. (2020) *TReND in Africa: Toward a Truly Global(Neuro)science Community*. Neuron 107(3), 412 - 416. DOI: 10.1016/j.neuron.2020.06.026
In 2011 I co-founded TReND in Africa, a non-profit organisation to promote science in the African continent. In this article, which was solicited by the Neuron editors, we discussed approaches to address some of the factors that currently stifle Africa's scientific development and our experience in implementing solutions to them. We also made recommendations to funders, governments and other organisations that were based on other data we had published, consisting of a meta-analysis of neuroscience output from Africa over the last 20 years.