University of Birmingham

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Reader in Developmental Neurobiology

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About

(/university/colleges/les/research-gallery/alicia-hidalgo.aspx) Our lab aims to understand how the nervous system – including the brain – is formed and works.

Qualifications

- 1990 PhD (DPhil) University of Oxford (Magdalen College)
- 1986 Licenciada en Ciencias Biológicas (equivalent to BSc in Biological Sciences), Universidad Complutense de Madrid, Spain

Biography

I grew up in Madrid, Spain, and carried out my first degree in Biological Sciences at the Universidad Complutense in Madrid, graduating in 1986. I obtained my PhD (DPhil) from the University of Oxford (Madgalen College) in 1990, on Drosophila developmental genetics and supervised by Prof. Phil W. Ingham. I subsequently (1990-1992) obtained a post-doctoral fellowship from the Spanish Ministry of Science and Education to do a post-doctoral period with Prof Antonio García-Bellido, at the Universidad Autónoma de Madrid, working on the control of growth and form in Drosophila development.

I returned to UK with a Marie Curie Human Capital and Mobility Fellowship to do a second post-doc with Prof Andrea H. Brand at the Wellcome/CR-UK Institute, University of Cambridge (1993-1997). After this, I was awarded a Wellcome Trust Research Career Development Fellowship to establish my independent research group at the Department of Genetics, University of Cambridge (1997-2002). Here, I established my line of research into neuron-glia interactions during nervous system development. In 2001 I received an EMBO Young Investigator Award for my achievements as a young group leader.

In 2002, I moved to the School of Biosciences, University of Birmingham, appointed Senior Lecturer, and where I consolidated my research into nervous system development using Drosophila.

Teaching

- BIO379, Module Leader: Cellular Neurobiology (Developmental neurobiology)
- BIO213: Topics in Medical Biosciences (Molecular bases of learning and memory)
- BIO240 Communication and skills in biosciences

Postgraduate supervision

PhD projects are offered in the general area of Developmental Neurobiology using the fruit-fly Drosophila as a model organism. Currently we are working in the areas of regeneration, neurotrophic factors and structural plasticity. We look at genes, molecules, neurons and glia in these contexts. Technical approaches include genetics, confocal microscopy, molecular biology and cell culture. We also collaborate with neurobiologists using mammals as model organisms, with biochemists, with electrophysiologists and with computer scientists

Masters projects are offered in the field of Developmental Neurobiology as above, and also in image processing.

For a list of possible PhD projects offered by Dr Hidalgo **www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Hidalgo (http://www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Hidalgo)**

Research

Research Theme within School of Biosciences:**Molecular and Cell Biology (/research/activity/cellbiology/index.aspx)**

Lab website address: www.biosciences-labs.bham.ac.uk/hidalgo/ (http://www.biosciences-labs.bham.ac.uk/hidalgo/)

Nervous system development: structural and developmental plasticity

Our lab aims to understand how the nervous system is formed, and how it works. Structure and function come together in the course of development, and influence each other throughout life, endowing the nervous system with plasticity. As the animal grows and nervous system volume and cell number increase, the two cell types in the nervous system - neurons and glial cells - make adjustments that modify migration patterns, axonal trajectories, cell division and cell survival. These plastic adjustments result in the robust, reproducible formation of the nervous system across individuals, and over evolutionary time. Conversely, these cell interactions fail in diseases of the nervous system and brain (e.g. neurodegenerative diseases, psychiatric disorders and brain tumours) and upon injury (e.g. upon spinal cord injury and stroke).

We use the fruit-fly Drosophila because it is a very powerful model organism to address questions swiftly, in vivo and with single cell resolution. Our approach combines genetics, molecular biology, cell culture, computational analysis and in vivo confocal microscopy in fixed specimens and in time-lapse. We collaborate with biochemists (Prof. N.J. Gay, Cambridge), electrophysiologists (Dr I. Robinson, Plymouth) and experts using mice and rats as model organisms (Prof. A. Logan, IBR Birmingham and Dr F. Matsuzaki, Riken, Japan).

We have recently discovered:
1. Drosophila Neurotrophins (DNTs):
That a neurotrophin protein family in Drosophila formed of DNT1, DNT2 and Spz regulate neuronal cell number, connectivity and synaptogenesis. This demonstrated conserved structure and function of the neurotrophin super-family from flies to humans. The findings support the notion that a common mechanism underlies the origin and function of all brains in evolution and that there are fundamental aspects in the way brain structure and function are linked, in fruit-flies and humans. These findings are important to use Drosophila as a model to understand the brain and to model brain diseases.

2. DNT receptors of the Toll superfamily
That the receptors for the DNTs belong to the Toll receptor super-family. Whereas Toll receptors have universal functions in innate immunity, we found that Toll-6 and Toll-7 in flies function as neurotrophin receptors to regulate neuronal number and targeting, and hebaviour. This reveals the distinct evolution of neurotrophin signalling, shared origins of the immune and nervous systems, and unforeseen relationships between the neurotrophin and Toll protein superfamilies.

3. A gene network for CNS repair in Drosophila.
We have a discovered a gene network that can promote injury repair in the CNS of Drosophila. We have established a novel paradigm to investigate central nervous system regeneration and repair in fruit-flies. We have shown that we can manipulate this gene network to prevent or promote injury repair. We are collaborating with mammalian experts to directly test whether this gene network also operates in mammalian glia using mice - closer to human conditions.

4. Research in Imaging.
To address questions on structural plasticity, it is essential to acquire quantitative information on cell number (e.g. the number of dying or dividing cells, neurons or glia, in different genotypes or conditions) and number of synapses. Thus we developed programmes to enable us to do exactly that, for the whole central nervous system of Drosophila embryos, larvae and the adult brain. We also developed a programme to track crawling larvae. All of our programmes were developed as ImageJ plug-ins and are freely available through our lab web-page.
Research by the Hidalgo group is funded by: The Wellcome Trust, BBRSC project grants and EU Marie Curie IntraEuropean and International Incoming Fellowship and The Royal Society, and in the past has also received funding from the MRC and EMBO and PhD studentships from the BBSRC, MRC and the Government of Brunei.

Other activities

- BBSRC Committee A core member
- Member of the British Society for Developmental Biology and The Genetics Society
- EMBO YI
- Co-director of **Birmingham Advanced Light Microscopy (BALM) facility (/facilities/balm/index.aspx)**
- Erasmus and International Exchange tutor for Biosciences
- Editorial Board member for journals *Neuron Glia Biology* and *International Journal of Developmental Biology*
- Fellow of the Society of Biology

Publications

Sutcliffe B, Forero MG, Zhu B, Robinson I and Hidalgo A (2013) Neuron-type specific functions of DNT1, DNT2 and Spz at the Drosophila neuromuscular junction. PLoS One, 2013 Oct 4;8(10):e75902. doi: 10.1371/journal.pone.0075902

McIlroy G, Foldi I, Aurikko J, Wentzell JS, Lim MA, Fenton JC, Gay NJ and Hidalgo A (2013) Toll-6 and Toll-7 function as neurotorphin receptors in the Drosophila melanogaster CNS. *Nature Neuroscience* 16, 1248-1256. doi: 10.1038/nn.3474. Recommended by Faculty of 1000 **http://f1000.com/prime/718049779?bd=1&ui=21597 (http://f1000.com/prime/718049779?bd=1&ui=21597)**

Kato, K., Hidalgo, A. An Injury Paradigm to Investigate Central Nervous System Repair in Drosophila.(2013) J. Vis. Exp. (73), e50306, doi:10.3791/50306. **http://www.jove.com/video/50306/an-injury-paradigm-to-investigate-central-nervous-system-repair (http://www.jove.com/video/50306/an-injury-paradigm-to-investigate-central-nervous-system-repair)**

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Hidalgo, Kato, Sutcliffe, McIlroy, Bishop and AlAhmed (2010) Trophic neuron-glia interactions and cell number adjustments in the fruit-fly. Glia DOI: 10.1002/glia.21092.

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Forero, Pennack, Learte and Hidalgo (2009) DeadEasy caspase: automatic counting of apoptotic cells in Drosophila. PLoS One 4, e5441.

Zhu, Pennack, McQuilton, Forero, Mizuguchi, Gu, Fenton and Hidalgo (2008) Drosophila neurotrophins reveal a common mechanism of nervous system formation. PLoS Biology 6, e284. See also pubcast at: **www.scivee.com/node/8389 (http://www.scivee.com/node/8389)** Recommended by Faculty of 1000: **http://f1000.com/prime/1158489 (http://f1000.com/prime/1158489)**

Learte, Forero and Hidalgo (2008) Gliatrophic and gliatropic functions of PVR signalling during axon guidance. Glia 56, 164-176

Griffiths, Benito-Sipos, Fenton, Torroja and Hidalgo (2007) Two distinct mechanisms segregate Prospero in the longitudinal glia underlying the timing of interactions with axons. Neuron-Glia Biology, 3, 75-88

Hidalgo, Learte, McQuilton, Pennack and Zhu (2006) Gliatrophic and neurotrophic contexts in Drosophila. Brain, Behaviour and Evolution 68, 173-180

Griffiths & Hidalgo (2004) Prospero maintains the proliferative potential of glial precursor cells enabling them to respond to neurons in the CNS. The EMBO J 23, 2440-2450

Kinrade & Hidalgo (2004) Local neuron-glia interactions change the response of axons to the Robo code. Neuron Glia Biology 1, 101-112.

Hidalgo & Griffiths (2004) Coupling glial numbers to axonal patterns. Cell Cycle 3, 1118-1120.

Hidalgo (2002) Interactive nervous system development: control of cell survival in Drosophila. Trends in Neurosciences 25, 365-370

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