Profile:

Elena Vecino

Basque Country Visiting Fellow 2012

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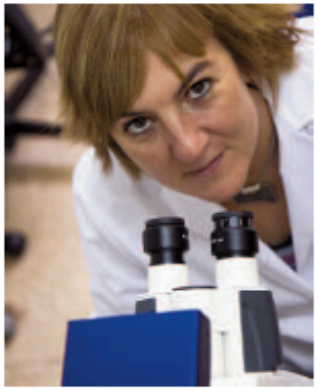

I am Professor at the University of the Basque Country in Spain and director of the Experimental Ophthalmo-Biology Research Group (www.ehu.es/GOBE). In 2012, I spent a sabbatical doing research at the Brain Repair Centre (BRC) accompanied by my husband, Antonio López, Professor of English Literature at the University of Salamanca, and our son Luis. During this time, we lived in Clare Hall, where I was the first recipient of a Visiting Fellowship from the Basque Country Government. My main research interest seeks to understand the causes of glaucoma, the second leading cause of blindness worldwide after cataracts, and the ways in which its effects can be stopped.

Glaucoma is a neurodegenerative disease characterised by the selective death of retinal ganglion cells (RGCs), which are the neurons responsible for sending information from the eye to the brain. The extension (axon) of these cells forms the optic nerve. Elevation of intraocular pressure (IOP) is a critical risk factor for glaucoma progression, and its lowering has become a major focus of intervention. However, many patients develop what is known as normal tension glaucoma, which is not associated with increased IOP. In many cases, RGC death continues after medical or surgical management of elevated IOP, but not all RGCs have the same sensitivity to the disease; some cells can survive for years, even with elevated IOP, whilst others die very early on after the first symptoms of the disease manifest themselves.

My research at Cambridge studied what makes some of our RGCs more resistant to cell death, an aspect fundamental to the understanding of glaucoma. At the BRC I collaborated with the research groups led by Professors Fawcett and Martin in a project which analysed which molecules could help RGCs regenerate *in vitro* and the different RGC subtype(s) that have the capacity to survive in difficult situations, as is the case in glaucoma. Dissociated RGCs from rat retinas were grown on different substrates that are present in the optic nerve, such as laminin, fibronectin and various collagens, in order to analyse their regenerative capacity, process extension and branching capability on these substrates. Additionally, the ability of these cells to express specific molecules associated with regeneration was also investigated. This experiment has shed more light on our understanding of the substrates on which RGCs regeneration can be improved *in vitro*.

A different research project developed at the BRC was carried out in collaboration with the Department of Physics at Cavendish and consisted of the analysis of RGC axons, which were shown to effectively regenerate at an angle, an experiment that mimicked the configuration of these cells in the optic nerve head of patients with glaucoma. For this project, microfluidic chambers were generated in which RGCs from dissociated rat retinas were introduced. We were able to make the RGC axons grow in these chambers forming 90° angles, thus proving that RGC regeneration is not affected by the curvature of their axon, which suggests that the position of the axons in the optic nerve of patients with advanced glaucoma is not detrimental to RGCs.

Since RGCs are members of the central nervous system (CNS), it is known that they do not effectively regenerate their axons in vivo, whereas neurons in the peripheral nervous system (PNS) do have this ability. Possible differences in intracellular transport were investigated in both of these systems. For this purpose, a spinning disc laser microscope was used, which has the capacity to take a picture every 3 seconds of very small fluorescent molecules. Using this technique, movies from single images were generated that were used to measure the characteristics of neurite regeneration. For the first time, the mechanisms for the regeneration of RGCs and PNS neurons could be compared using this methodology.

The results of this work were presented at an international joint conference that I organised at Clare Hall in June 2012, entitled 'Regeneration of the Nervous System: Intrinsic and Extrinsic Factors'. This was funded by the Basque Country Government, and attracted more than 60 researchers from Cambridge, the USA and the Basque Country.

Cambridge is one of the greatest cities in the world, in which the highest scientific and cultural achievements are combined, and hence, a wonderful place to regenerate the mind and spirit during my sabbatical leave. Also, the atmosphere at Clare Hall makes anyone's stay wonderful. One can experience the changing seasons in the gardens, attend many concerts during the academic year and enjoy the excellent art exhibitions. Luis learned new sports at St. John's College School each term and participated as an actor in the wonderful play, *The Sound of Music*. Most importantly, we had the privilege of interacting with outstanding people at Clare Hall and in the rest of the university and this made our stay in Cambridge an unforgettable period in our lives.

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