OFERTA PROYECTO PARA AYUDAS PARA CONTRATOS PREDOCTORALES PARA LA FORMACIÓN DE DOCTORES 2018 (Antiguas FPI)

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<th>REFERENCIA PROYECTO</th>
<th>FIS2017-84753-R</th>
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<tr>
<td>INVESTIGADOR PRINCIPAL (IP)</td>
<td>Susana Marcos (IP); Carlos Dorronsoro (co-IP)</td>
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<td>TÍTULO PROYECTO</td>
<td>Nuevas tecnologías para entender y tratar la miopía</td>
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<td>ÁREA CIENTÍFICA</td>
<td>Óptica; Física biomédica; Óptica Visual y Biofotónica</td>
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<td>CENTRO/INSTITUTO</td>
<td>Instituto de Óptica</td>
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<td><a href="http://www.vision.csic.es">www.vision.csic.es</a></td>
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RESUMEN PROYECTO/PROJECT SUMMARY (Máximo 3.000 palabras)

**Motivation**
During development the eye grows in a coordinated manner, so that the ocular optics projects an image that is focused on the retinal plane (emmetropia). However, in myopia, emmetropization is disrupted and the eye grows excessively in the axial direction, so that images focused in front of the retina, resulting in blurred images on the retina. Myopia prevalence has shown a dramatic increase in the last few decades. Now, myopia affects 25-30% of the population in western countries, and in some areas of Asia, it has reached epidemic values, around 90% (Holden et al. 2014). Compensation of myopia with negative lenses has been done for centuries, and more recent correction strategies include contact lenses, orthokeratology, corneal refractive surgery, corneal implants or intraocular lenses (phakic or clear crystalline lens extraction). All these techniques aim at changing the refractive power of the ocular optics, but the morbidity associated to axial elongation (retinal detachment, glaucoma, and other eye-sight threatening conditions) persists.

The etiology of myopia is not well understood. It is well accepted that environmental factors play a large role in myopia development, however debates are still ongoing on whether the amount of near work, reduced time outdoors or other factors intervene. Much of the knowledge gathered on myopia development comes from animal models (chicken, marmosets, mouse tree shrews, macaques, and, more recently, guinea pigs) as they allow testing cause-effect relationships and performing longitudinal studies in relatively short Although the extrapolation of some findings to human are still under debate, the value to the understanding biological, biochemical and physical changes during myopia development as well as the effect of interventions is unquestionable.

Despite the high prevalence of myopia, several key questions still remain, in part because of the unavailability of quantitative techniques to characterize optical and morphological properties of the myopic eye, and structural changes produced by intervention. On the other hand, as vision is a neural process, the differential blur perception in myopes, and perceptual aspects of some novel myopia treatments have not been investigated.

In this project we plan to give insights to important questions open in myopia and its treatment: (1) How the ocular components loose coordination when myopia develops? (2) What is the role of the crystalline lens in myopia development? (3) How myopes process and adapt to blur? (4) How the newest myopia stopping treatments work and how can they be improved? (5) How does the sclera change at the biomechanical and microstructural level when myopia develops? (6) Can scleral cross-linking be an effective technique for myopia treatment?
Objectives

The proposal will develop new optical imaging technologies and new paradigms for assessing the myopic eye, and changes produced by novel myopia control treatments. In particular, the project will target the following objectives:

1. Development of innovative imaging methods for quantification of the ocular geometry and biometry, in particular the crystalline lens.
2. Implementation of adaptive optics visual simulator to measure blur discrimination.
3. Implementation of simultaneous vision simulators to simulate bifocal corrections for the control of myopia progression.
4. Development of second harmonic generation microscopy for the sclera.
5. Crystalline lens full shape parameters in human myopes, and during myopia progression in animal models.
8. Scleral properties in myopes and following cross-linking intervention.

The Visual Optics and Biophotonics Lab

The Fellow will join a highly dynamic multidisciplinary group, led by Prof. Susana Marcos. The group has an extraordinary research and technological track. In the last years more than 50 students and professionals have trained in the lab, with 17 PhD students have defended their thesis in VioBio Lab projects, now holding high-end positions in academia and industry around the world. The Fellow will benefit from the following aspects:

1. A large breadth of funded research projects (Spanish Government, European Research Council, Marie Curie, H2020 Innovation Action, collaborative projects with industry)
2. Highly international environment (predoctoral and postdoctoral fellows from 8 countries) and frequent visitors from around the world
3. Close relationship with international laboratories in the US (Harvard University, MIT, University of Miami, University of Nevada), Europe, Asia and Australia
4. Close relationship to industry (CSIC Spin-offs 2EyesVision, Madrid; Pleoptika, Boston, and major ophthalmic companies around the world, including Johnson & Johnson, Abbot Medical Optics (USA), Essilor International (France), HOYA Surgical (Singapore), Alcon Research Labs (USA) among others
5. Summer Schools and internal laboratory programs (VioBio Theme Sessions, VioBio Come Along)
6. Opportunity to participate in the Institute of Optics Student Chapter of the Optical Society of America, and activities of technological platforms (SECPHO, Photonics 21)

Candidate Profile

We are seeking for a highly motivated individual, willing to contribute to a multidisciplinary environment, thrilled to work at the interface of physics and biology, searching to conduct research of excellence while creating an impact on society

Preferred BSc in Physics, Biomedical Engineering, Electrical Engineering. Knowledge of optics and vision and experience in a research lab (academic or industry) is considered a bonus. Excellent scores in degree and fluent english is required.