

## CORTICAL CIRCUITS LABORATORY-



### Cajal Institute; Universidad Politécnica de Madrid (UPM)

PI: Javier DeFelipe, PhD.

**Internship type:** Research

**Language:** English/Spanish

**Location:** Center for Biomedical Technology, UPM-Montegancedo Campus, Pozuelo de Alarcon; Cajal Institute, CSIC, Madrid. <http://www.cajal.csic.es/ingles/index.html>  
<http://www.upm.es/MontegancedoEN/Montegancedo>

We dispose of two laboratories. The main laboratory is located within the new CBT complex at the UPM (Pozuelo de Alarcon), while the other laboratory is located at the "Instituto Cajal". The main lab includes an Image Analysis room with several computers and microscopes for image acquisition and analysis, as well as Confocal and Electron Microscope Facilities. Furthermore, a large amount of laboratory space is dedicated to histology with the ultimate generation of equipment for various histological/ immunohistochemical techniques, tissue sectioning, intracellular injections in fixed tissue and small animal handling.

### **Summary**

Our laboratory principally focuses on the micro-organization of the normal cerebral in various species, particularly humans, and on the alterations of cortical circuits in epilepsy and Alzheimer disease. These studies are performed through the use of anatomical tracers, high resolution immunocytochemistry and 3D electron microscopy. Another major aim is to develop IT technologies to examine the brain. The study of the human brain is extremely challenging — not only due to its complexity and technical difficulties, but also because ethical limitations do not allow all of the necessary datasets to be acquired directly from human brains. Furthermore, there are fundamental structural and behavioral aspects that are unique to humans, and the functional significance of the human-specific structure should be dealt with by employing a range of specific strategies. For these reasons, we are deeply committed to studying the micro-organization of the human brain and its relevance in understanding its normal and pathological conditions. Indeed, a major goal of the *Laboratorio Cajal de Circuitos Corticales* is to improve the current technologies for the micro-anatomical analysis and 3D reconstruction of the human brain by adapting methodologies normally used to examine the brain of experimental animals.

### **Methodology**

Professor DeFelipe has access to a bank of human brain tissue —Banco de Tejidos Fundación CIEN” (BTFC; Centro Alzheimer, Fundación Reina Sofía, Madrid, Spain), which follows national laws and international ethical and technical guidelines on the use of human samples for biomedical research purposes. We use immunohistochemical techniques, classical labeling techniques in combination with advanced imaging techniques like laser scanning confocal microscopy, electron microscopy and ultramicroscopy.

**Activities**

Students will have the opportunity to participate in various experiments (to be determined upon arrival), learn about different histochemical and immunocytochemical techniques for optical and electron microscopy and Image processing; 3D reconstruction methods (confocal and FIB/SEM microscopy); tract-tracing anatomical methods; stereology, as well as Intracellular injection in fixed tissue.

**Requirements**

Typically students should have passed an introductory neuroscience course. The research questions are generated by faculty, but approaches and methods will be feasible for students participating in research for the first time. The internship is designed to maximize student experience and learning while doing meaningful research.