INHIBITORY NEURON CLASSIFICATION AND DISTRIBUTION ACROSS THE CEREBRAL CORTEX OF THE MARMOSET MONKEY (CALLITHRIX JACCHUS)
Gabriella Rasmussen (Alessandra Angelucci)
Department of Medicine: Neuroscience & Opthalmology

The brain flows and functions through the action of excitatory neurons, yet for the brain to function properly that excitation must be regulated by inhibitory cells. Many brain disorders are a result of imbalance between excitation and inhibition. These disorders include seizures, Schizophrenia, and Autism. (O'Donnell, Goncalves, Portera-Cailliau, Sejnowki, 2017). This is why inhibitory neurons are so essential, this special class of neurons slows down and/or stops this excitation when necessary. These neurons only make up 20-25% of the neuronal populations of the brain, yet their function is incredibly important for maintenance of proper brain function (Travaglio & Jones, 2017). These inhibitory cells have been subdivided into three main classes based on morphology, function and molecular markers. The three main classes include Somatostatin (SOM), Parvalbumin (PV), and Vasoactive Intestinal Polypeptide (VIP). What little is known about the laminar distribution and cellular function of these inhibitory interneuron subclasses (in the cortex) is based on rodent studies. To bridge the gap from understanding the role of inhibition in mice to human vision, we used standard immuno-histochemical (IHC) techniques to identify the laminar distribution of inhibitory neurons in the cerebral cortex of Marmosets.

In this project, we explored the distribution of inhibitory neurons throughout the layers of the marmoset cortex. The inhibitory neurons in the marmoset are being studied due to the marmoset's similarity to the human brain, which is much more so than mice or rats. The distribution of inhibitory neurons has already been discovered, quantified, and is known in mice.

Yet, this information is yet to be discovered in the primate model which will be helpful knowledge to apply to human models. By probing each subclass of neurons using IHC, these neurons can be counted and quantified. An antibody against GABA was used to identify all inhibitory interneurons and antibodies against PV and SOM were used to identify the distribution of these PV+ and SOM+ cells. The boundaries between cortical laminae in marmoset (Layers 1, 2/3, 4a. 4b. 4c, 5, 6 from pia to white matter) were identified using a fluorescent Nissl stain. The distribution of these inhibitory neuron cells through these layers was manually counted and the density of each subclass in each layer was quantified (cells/mm2 in each layer). It is hoped that once the distribution data is quantified, a standard for inhibitory neuron distribution through the layers will be found that can then be built upon in future research.