From Eye to Insight

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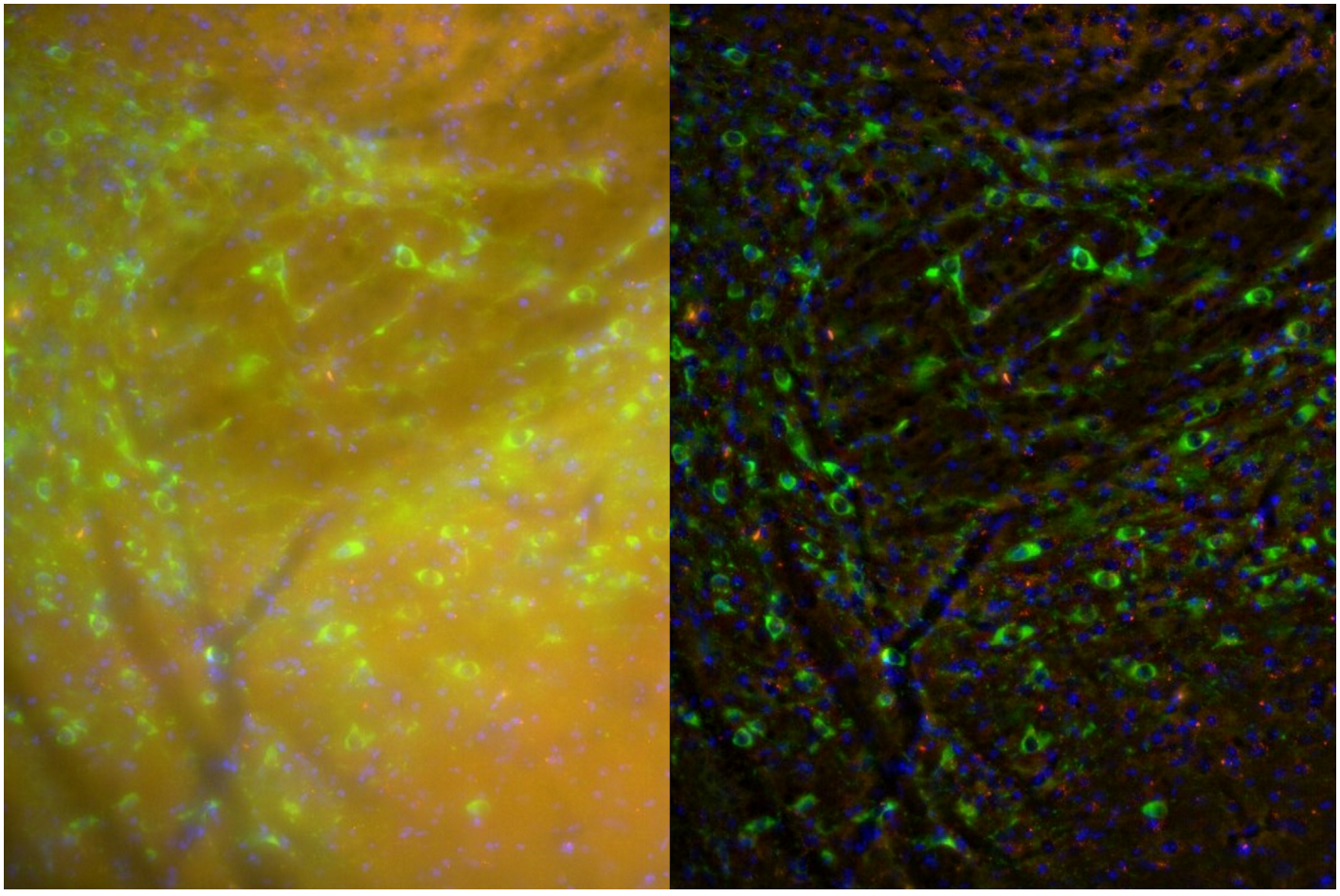
EXPRESSION OF D2-DOPAMINE RECEPTORS IN NEURONS

Rapid, high-contrast imaging of the substantia nigra in mouse brain



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Abstract

This article discusses how D2-dopamine receptors (D2R) in the substantia-nigra of mouse brain can be more clearly revealed with a THUNDER Imager 3D Assay using Instant Computational Clearing (ICC) than conventional widefield microscopy. Researchers can also better optimize the antibody staining of brain specimens using a THUNDER Imager. The D2R is a postsynaptic receptor and is highly expressed in the striatum. Its activation leads to signaling pathways concerning cell differentiation, growth, metabolism, etc. D2R is also important for dopaminergic neurotransmission and motor control. This type of neuroscience research seeks to better understand how gene expression contributes to disorders like Parkinson's disease, dystonia, chorea, psychosis, etc.

Introduction

Activation of the D2-dopamine receptor (D2R), a postsynaptic receptor which is highly expressed in the striatum, brings about signaling pathways related to cell differentiation, growth, metabolism, and apoptosis. D2R also has an important role in dopaminergic neurotransmission and motor control. The aim of neuroscience research is to have a comprehensive understanding of how alterations in gene expression contribute to cognitive dysfunctions arising from disorders like Parkinson's disease, dystonia, chorea, hypersomnolence, obsessive-compulsive disorder, psychosis, and emotional lability. The expression level of D2-dopamine receptors in neurons [1,2] from the substantia-nigra area [3] of mouse brain was examined during this study. The image results can be very unclear when using traditional fluorescence widefield imaging, so often confocal microscopy is used instead [4]. The results of this study show that D2-dopamine receptors (D2R) in the substantia-nigra pars-compacta area of mouse brain can be more clearly revealed with a THUNDER Imager 3D Assay using Instant Computational Clearing (ICC) compared to conventional widefield microscopy.

Challenges

For this neuroscience research, an imaging solution that can quickly screen brain specimens is very useful. High-quality images are also necessary so that stained dopamine receptors can be clearly resolved. The imaging of thicker specimens requires a solution capable of good contrast at points deep inside them. Widefield microscopy is fast and provides detection sensitivity, but the out-of-focus blur or haze seen with thick specimens due to signals from out-of-focus planes reduces significantly image contrast [5,6].

Methods

Specimens of the substantia-nigra pars-compacta area of mouse brain, which were immunostained to indicate the D2-dopamine receptors (D2R) (red), neurons (TH antibody, green), and nuclei (DAPI, blue), were used for this study. The brain specimens were imaged with a THUNDER Imager 3D Assay, an inverted compound microscope platform, and Instant Computational Clearing (ICC) was applied.

Results

For this study, the THUNDER images after ICC (refer to figure 1) revealed a clear view of details deep within a mouse brain specimen in real time without out-of-focus blur or haze.

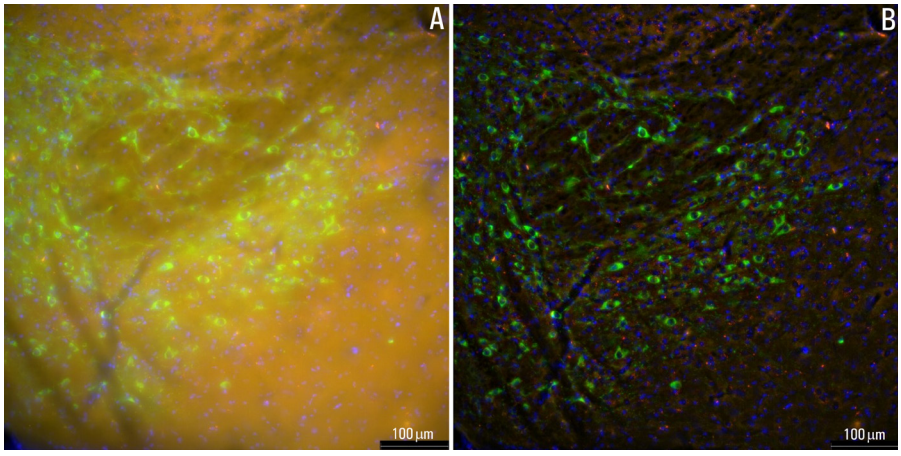

Figure 1. Images of mouse brain showing D2R (red), CA neurons (green), and nuclei (blue): A) raw widefield data and B) after ICC. Images courtesy of Dr. Qi Wang, Baylor College of Medicine, Houston, TX, USA.

Conclusion

The THUNDER images can show better where the stained receptors are located in the brain when compared to conventional widefield imaging results.

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