

Color Dependence of OLED Phototherapy for Cognitive function and Beta-Amyloid Reduction through ADAM17 and BACE1

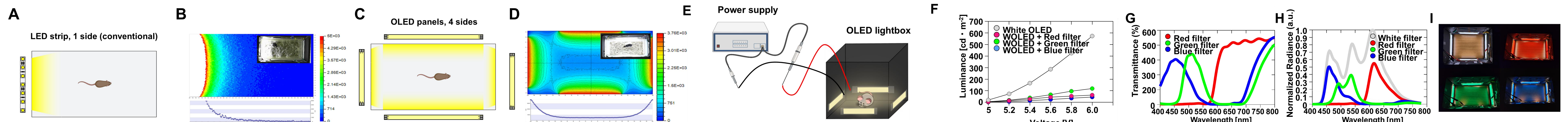
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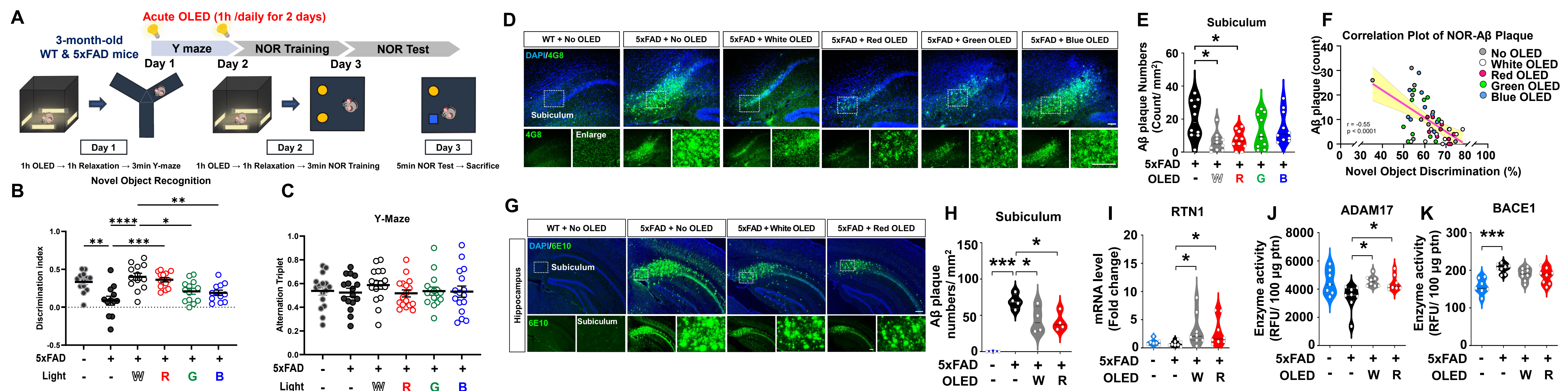
Abstract

Previous studies have reported that 40 Hz visual stimulation (acute white light exposure) reduced A β levels in Alzheimer's disease (AD) mouse model. However, whether different light color distinctly regulate AD pathologies has not been well characterized. In the present study, an optimized Organic Light-Emitting Diode (OLED)-based visual stimulation platform was developed to provide uniform illumination without blind spots, and the color-dependent effects on cognitive function and amyloid- β (A β) pathology were investigated in 5 $\times$ FAD mice, an A β -overexpressing AD model. Acute exposure to white or red OLED light (1 h/day for 2 days) significantly improved cognitive function, reduced hippocampal A β plaque accumulation via increasing ADAM17 activity, and downregulated proinflammatory cytokine IL-1 β levels in 3-month-old 5 $\times$ FAD mice, whereas green or blue OLED light did not produce these effects. In addition, chronic white and red OLED stimulation (1 h/day for 2 weeks) was shown to enhance recognition memory; however, only red light further diminished A β plaque deposition by upregulating ADAM17 activity and suppressing BACE-1 activity without altering neuroinflammation in 6-month-old 5 $\times$ FAD mice. Moreover, acute white and red OLED exposure (1 h, single session) was observed to enhance c-fos expression, which is associated with neural activation along the visual pathway, thereby suggesting a mechanistic link between light stimulation and cognitive enhancement. Taken together, these findings demonstrate that color-dependent visual stimulation may serve as a promising electroceutical strategy for AD, with red light uniquely combining memory enhancement, A β reduction via ADAM17 upregulation and BACE1 suppression, and anti-inflammatory effects.

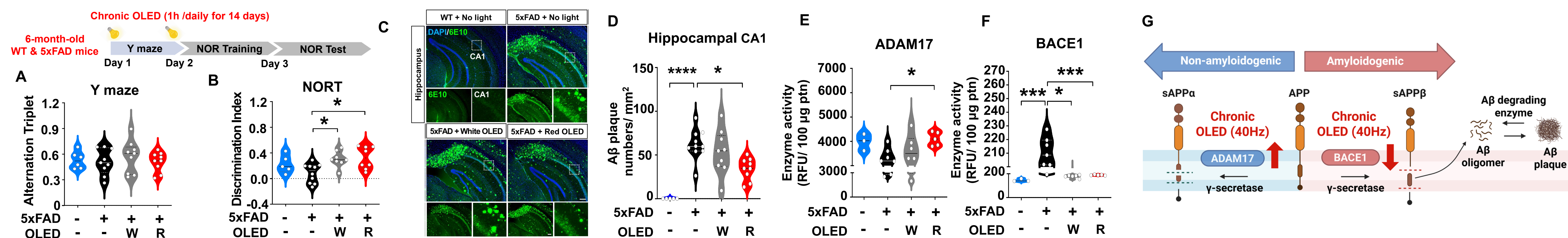
Schematic and Characteristics of OLED Light Stimulation



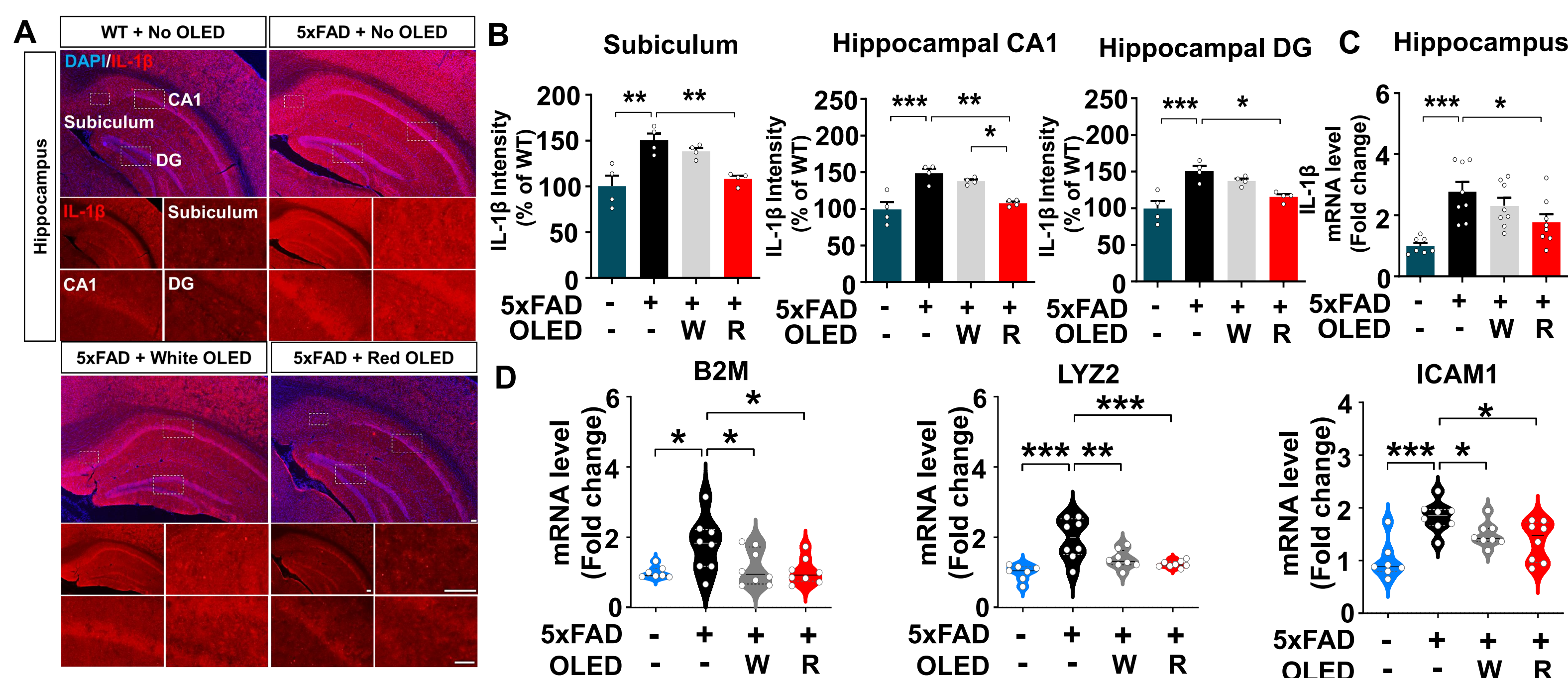
Acute OLED stimulation reduces A β plaque accumulation via ADAM17 activity in 3-month-old 5 $\times$ FAD mice



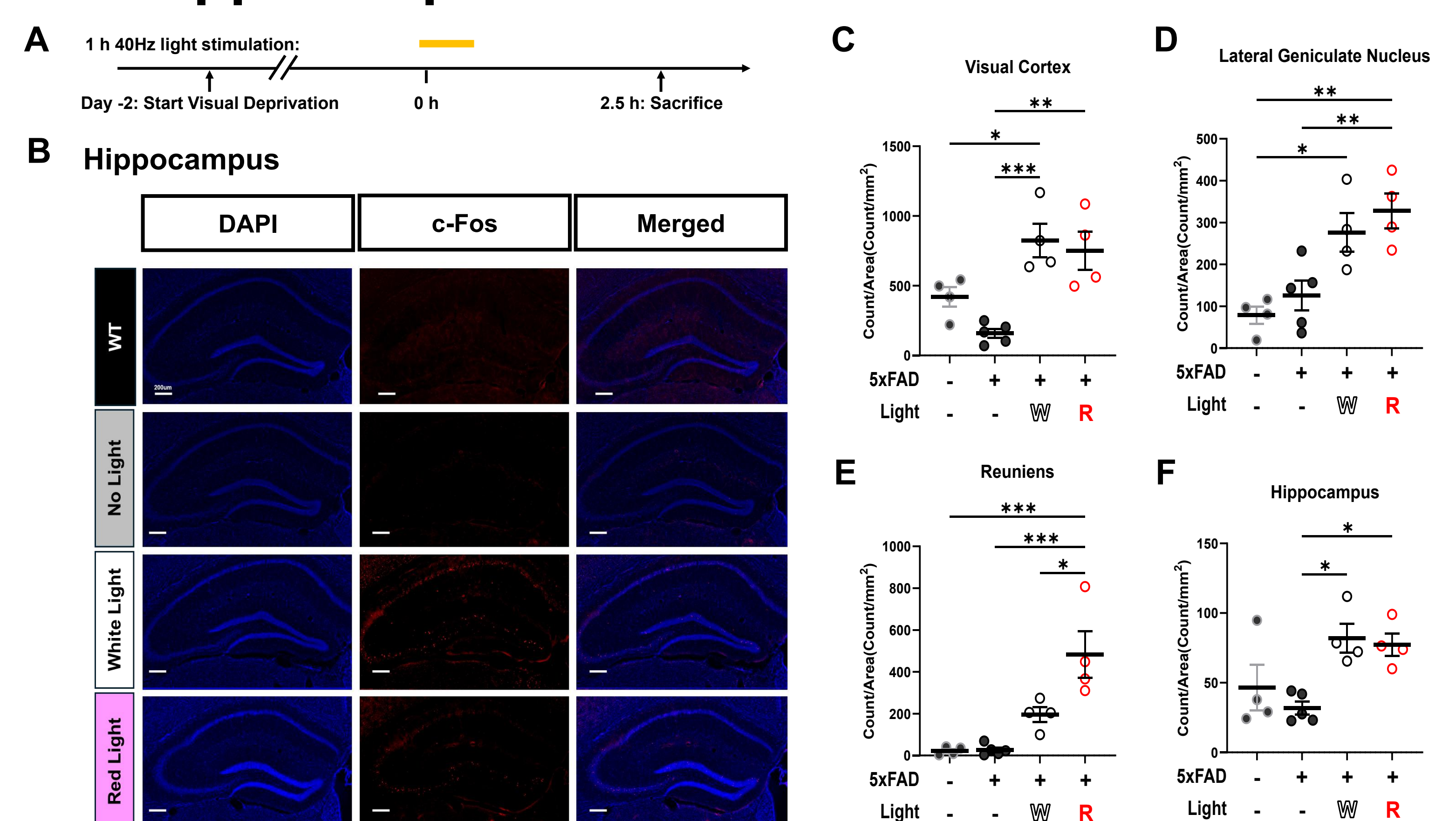
Chronic OLED stimulation enhances long-term memory and suppresses A β plaque deposition by increasing ADAM17 activity and decreasing BACE1 activity in 6-month-old 5 $\times$ FAD mice



Acute OLED stimulation decreases pro-inflammatory cytokine IL-1 β and DAM markers in 3-month-old 5 $\times$ FAD mice



Acute OLED stimulation showed significant c-Fos activation in regions of visual pathway and hippocampus in 3-months-old 5 $\times$ FAD mice



Acknowledgements

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