Learning during development is regulated by an unexpected brain region

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A half-century of research on how the brain learns to integrate visual inputs from the eyes has provided important insights in critical period regulation, leading to the conclusion that it occurs within the cortex. A group of researchers has discovered that a brain region that passes on input from the eyes to the cortex also plays a crucial role in opening the critical period of binocular vision.

During childhood, the brain goes through critical periods in which its

learning ability for specific skills and functions strongly increases. It is assumed that the beginning and ending of these critical periods are regulated in the cortex, the outermost layer of the brain. However, scientists from the Netherlands Institute for Neuroscience discovered that a structure deep in the brain also plays a crucial role in the regulation of these critical periods. These findings, published today in the leading journal *Nature Neuroscience*, have important implications for understanding developmental problems ranging from a lazy eye to intellectual disability.

We can only learn skills and functions such as speaking a language or binocular vision during critical periods of development. When these developmental forms of learning fail, lifelong problems arise. Using electrophysiological recordings in genetically modified mice, they showed that the thalamus contains inhibitory neurons that regulate how efficiently the brain learns to integrate binocular inputs. Levelt says, "To improve developmental problems resulting in learning problems during critical periods, reinstating flexibility in the visual cortex may not be sufficient. Scientists and clinicians should not limit themselves to studying cortical deficits alone. They should also focus on the thalamus and the way it preprocesses information before it enters the cortex."

The study may also provide some hope for people with albinism, who often have limited binocular vision due to misrouting of inputs from the eyes to the thalamus. Levelt's team found that in contrast to what is generally assumed, plasticity of binocular vision also occurs in the thalamus itself, suggesting that this might be improved in children with albinism through training.

More information: Thalamic inhibition regulates critical-period plasticity in visual cortex and thalamus, *Nature Neuroscience* (2017). nature.com/articles/doi:10.1038/s41593-017-0002-3

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