**How Social Isolation Affects the Brain**

**Being alone greatly changes some brain regions more than others.**

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Key points

* Our need for social interactions is as fundamental as our need for proper nutrition and adequate sleep.
* Social isolation causes decreased white matter in brain regions critical for thinking and emotional control.
* Connectivity changes between the amygdala and frontal lobes are associated with increased behavioral problems.
* One of the most important consequences of society’s response to COVID-19 was the clear demonstration that our need for social interactions is as fundamental as our need for proper nutrition and adequate sleep.
* Physical distancing, quarantines, and lockdowns increased the incidence of depression in adults and adolescents. Past psychological studies documented that people experiencing prolonged social isolation, such as orphans and empty nesters, have an increased risk of depression and insomnia.

Monkeys raised in partial or total isolation since birth were hostile toward others and could not form adequate social attachments in adolescence or adulthood. The degree of social damage was related to the duration of social isolation. Sophisticated neuroimaging analyses of humans and monkeys revealed structural alterations in two critical brain regions for normal social interactions and emotion control, the prefrontal cortex and amygdala. To a somewhat smaller degree, changes were also observed in the hippocampus. The total volume of the amygdala was consistently larger in response to social isolation; this likely underlies the profound emotional problems observed.

Cellular changes in response to social isolation included significant alterations in oligodendrocyte development. Oligodendrocytes form the myelin, which is called white matter. It is critical for neuronal communication. Neuroimaging studies reported abnormalities of consistently reduced total gray and white matter volumes in the prefrontal cortex and hippocampus. The loss of total white matter likely explains why electroencephalography (EEG) analyses have reported abnormal patterns of brain activity in the frontal, temporal, and occipital brain regions in children reared in social isolation.

These changes in neural activity reflect a significant delay in cortical maturation. Children who experienced early social isolation, such as in orphanages, showed decreased white matter integrity, particularly in neural pathways that connect the frontal and temporal lobes, where thinking and memories are processed. The changes in connectivity between brain regions were associated with increased behavioral problems. One specific change, the loss of connectivity between the prefrontal cortex and amygdala, which are believed to be critical for emotion regulation and fear learning, was considered most responsible for the continued immature behaviors and social problems of children after long-term social isolation.

In adults, after social isolation, the dopamine neural systems became selectively activated when shown pictures of social activities. For comparison, a similar response is seen in response to food cues after prolonged fasting. A recent study reported that the multi-year reduced social interaction due to COVID-19 resulted in volumetric increases in the bilateral amygdala, putamen, and anterior temporal cortices.

Most importantly, the changes in the amygdala were reduced as time elapsed after the release from lockdown. This suggests that, in adults at least, the brain changes due to the prolonged social isolation associated with the COVID-19 lockdown are reversible.

THE BASICS

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