Two recent studies from Denmark and Spain have found evidence suggesting that psychedelics may cause lasting and positive changes in the brain, specifically in the prefrontal cortex and the hippocampus. Researchers say the findings are significant as deterioration of neurological functioning in these areas is strongly associated with mental and behavioral health issues including depression, anxiety disorders, PTSD, OCD, and addiction.

If these discoveries are verified by further research, scientists say they may have discovered an underlying neurophysiological mechanism that helps explain why psychedelics appear to help relieve the most disabling symptoms of depression and anxiety.

Psilocybin and its Effect on the Prefrontal Cortex

Publishing in the November edition of the Journal of Psychopharmacology, a team of researchers affiliated with Aarhus University in Denmark presented the results of a study that analyzed the effects of psilocybin on the brains of rats. Found in many species of fungus, psilocybin can produce powerful visionary and psychedelic experiences. The rats used in the Aarhus University study were given doses of psilocybin in varying quantities. Postmortem examinations of RNA samples taken from different parts of the rat's brains showed that psilocybin stimulates the expression of formerly dormant genes associated with neuroplasticity – the brain's ability to produce new neurons and create fresh neural connections in areas where neural mass and functionality have been lost.

"Our results indicate that psilocybin has an immediate effect on some of the mechanisms that regulate brain plasticity, especially in the prefrontal cortex of the brain," says Oskar Hougaard Jefsen, a visiting researcher working in Aarhus University's Translational Neuropsychiatry Unit. "These neurobiological effects may help explain why a psychedelic trip is sometimes experienced as 'transformative.'"

The prefrontal cortex plays a critical role in impulse control, emotional management, and advanced cognitive functioning. Sudden improvement in these capacities may be experienced as a dramatic shift of consciousness. This could be especially true for those struggling with depression or uncontrollable anxiety, which are known to correlate with depleted neuron counts and the rupture of neural connections in the prefrontal cortex.

Neuroplasticity is a remarkable regenerative process. Unfortunately, the brain's capacity to reboot damaged neural circuitry declines significantly after childhood. This leaves adult brains unable to repair themselves or to replicate lost neurons or decayed neural networks. If psilocybin can induce renewed neuron growth and the regeneration of synaptic connections between neurons, it would essentially restore the brain to a more "childlike" state, in the best meaning of that phrase.

These new findings could be interpreted as supporting the efficacy of psilocybin as an antidote to depression and similar conditions. But Jefsen cautions against reaching a conclusion prematurely.

“Whether or not psilocybin (or other psychedelics) can be used to treat mental health conditions cannot be determined from our studies,” says Jefsen.. “That needs to be determined through well-designed clinical trials.”

Jefsen points out that research involving rodents may not produce results that automatically translate to human beings, in either their nature or their scope.Nevertheless, he notes that there is a close enough analog between the brains of rats and humans to suggest an overlap.

Ayahuasca, DMT, and the Regeneration of the Hippocampus

Scientists affiliated with Complutense University of Madrid, Spain, conducted a second recent study that confirms the ability of psychedelics to stimulate renewed plasticity in the brain.

In this study , the researchers tested the effects of the psychedelic compound DMT (N,N—dimethyltryptamine)on the brains of mice. The researchers administered the DMT in the form of ayahuasca.

A decoction of the *Psychotria viridis* and *Banisteriopsis caapi* plants, ayahuasca brews are traditionally made with the leaves of *P. viridis which* contain DMT. The vine of *B. caapi* contains β-carboline alkaloids that are monoamine oxidase type A inhibitors. These chemical compounds combine synergistically to catalyze the ayahuasca experience.

The researchers focused specifically on the effects of DMT on the hippocampus, an area of the brain associated with learning and memory. Genes that are known to express for neuroplasticity were again found to have been activated in this area. The study showed that this resulted in an increase in the number of neurons in this region where shrinkage of brain mass is common in people with neurodegenerative disorders like Alzheimer’s and in those who suffer mental health conditions such as depression. The mice that were given DMT outperformed control mice in memory tests, verifying the immediate effectiveness of DMT therapy.

“Human beings have in the brain all the cellular machinery to form [new] neurons, but they do not normally do it,” explains José A. Morales-García, an associate professor at Complutense University who participated in the ayahuasca study and co-authored the September 2020 report in Translational Psychiatry that revealed these findings. “Their neural stem cells are inactive.

Our study demonstrates that we can stimulate endogenous neural stem cells to form new neurons."

Morales-García lauds the potential of DMT as a therapeutic substance for a range of neurodegenerative diseases. He explains that attempts to spur neuroplasticity in the brain via neural stem cell injection have met with complications, which could be avoided if psychedelics were used as an alternative therapy.

Deterioration in neural density and functioning in the prefrontal cortex and hippocampus clearly correlate with certain forms of mental illness. Any chemical that can reverse this decline, stimulating the renewed construction of healthy neural networks, could have an impact on moods and emotions and on a person's capacity to regulate them effectively.

DMT and psilocybin belong to the tryptamine class of hallucinogens. But tryptamines are not the only type of psychedelic compounds known to have plasticity-inducing effects. Previous research shows that LSD and ibogaine are also known to activate genes linked to neuroplasticity in the brain. Ketamine, which is currently used in psychedelic-assisted psychotherapy, may also encourage renewed expression of neuroplasticity-inducing genes in the prefrontal cortex and hippocampus.

This is an example of what I can write about psychedelics.