

# The Overlap Between Neuroscience and Psychiatry: An Exploration of the Effectiveness of Neurological Applications in Treating Psychiatric Disorders

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## Abstract

Neuroscience and psychiatry, once indistinguishable fields, had developed into their own disciplines over the course of the 20th century. By the end of the 20th century and the beginning of the 21st century, however, developments in neuroscience that enable psychiatric disorders to be treated in terms of structural abnormalities of the brain have led to a possible reunification between the two fields, though the fields still remain separate today.

Neuroscience and psychiatry have a historically complicated dynamic, originating as the unified field of neuropsychiatry and later diverging into two separate fields of study. Neuroscience is the study of the nervous system and the brain. A critical branch of neuroscience that is concerned with the nervous system and brain-related diseases is neurology. Psychiatry, like neurology, is also concerned with brain abnormalities, but, unlike neurology, psychiatry is the study of mental illnesses. Mental illnesses differ from neurological disorders in that they cannot be solely identified and treated through somatic, physical, symptoms and their mediation. This is because mental disorders are often associated with environmentally-induced trauma. However, as research in neuroscience develops, there is evidence to suggest that certain psychiatric disorders can be linked to structural abnormalities, like chemical imbalances in the brain, intertwining the fields of neuroscience and psychiatry once again (Baker et al., 2002). Though a trend towards reunification between the two disciplines has been established, neuroscience and psychiatry remain distinct but work in tandem for the most effective treatment of psychiatric disorders.

The treatment of psychiatric disorders in a neurological context could be seen in the 20th century with electroconvulsive therapy (ECT). The first documented case of ECT was recorded in the 1930s, known as shock therapy (Shorter, 2008). As broken down by Mayo Clinic (2018), ECT passes electrical currents through the brain to trigger a short seizure and reconfigure its chemistry in such a way that relieves the symptoms of certain mental illnesses. Controversy around ECT stems from its initial implementation, which unsafely sent high doses of electricity through the brains of patients without anesthesia, potentially leading to confusion, memory loss, broken bones, or heart complications in the patient. Developments in anesthesia eventually made ECT safer in treating psychiatric disorders, though the stigma of ECT still remains. In contrast, modern-day ECT occurs in a highly-controlled environment where the brain, heart, blood pressure, and oxygen levels of the patient are monitored as they are under anesthesia (Mayo Clinic, 2018). ECT is considered highly effective in patients who have severe depression that remained unaffected by other treatment methods, with more than 50% of severely depressed individuals experiencing improvement in their

symptoms (Khalid et al., 2008). ECT has also been proven effective in treating schizophrenia, with 77% of schizophrenic individuals responding to ECT (Kaster et al., 2017). Remission post-treatment is common, with many individuals undergoing a series of ECT treatments to manage their symptoms over time (McKenna, 2021). ECT may also be coupled with other methods of treatment, like medication.

Another conversation surrounding the application of neuroscience to psychiatry surfaced with Irwin and Miller's (2007) "Depressive disorders and immunity: 20 years of progress and discovery," which developed the cytokine model of depression. In depression, it is found that signaling proteins that regulate immunity, cytokines, are produced in high concentrations in a pro-inflammatory form. Large amounts of pro-inflammatory cytokines activate enzymes that convert tryptophan, an amino acid of serotonin, into a form that can no longer be used for serotonin synthesis (Miller et al., 2013). The low levels of serotonin seem to be a cause of depression according to the "serotonin hypothesis" (Albert et al., 2012). Therefore, according to Irwin and Miller, a viable method of treating depression is to limit pro-inflammatory cytokine production through medication, as this would increase serotonin production. Depression was first explained in terms of serotonin more than 50 years ago. With new findings, the "serotonin hypothesis" has been met with inconsistencies, as explained by Paul Albert's analysis of it. Individuals without mental disorders who had their serotonin levels experimentally reduced exhibited little to no change in mood. Antidepressants that increase serotonin levels were found to not necessarily work for all individuals with depression, and antidepressants that do not raise serotonin levels can also aid in depression treatment (Albert et al., 2012). This is not to say that the "serotonin hypothesis" is not credible. The most commonly prescribed antidepressants are selective serotonin reuptake inhibitors (SSRIs), which increase serotonin levels. These antidepressants are about as effective as their competitor, serotonin and norepinephrine reuptake inhibitors, which increase both serotonin and norepinephrine levels (U.S. National Library of Medicine, 2020). A study published by the U.S. National Library of Medicine (2020) evaluated the efficacy of antidepressants, revealing that 40 to 60 people out of the 100 who took antidepressants had their severe depression symptoms alleviated within six to eight weeks, while 20 to 40 people out of the 100 who took a placebo experienced the same result. Although this suggests that antidepressants improve severe



depression symptoms in about 20 people out of 100 within six to eight weeks, there are still a significant number of individuals who did not see any improvement in their severe depression symptoms despite taking antidepressants. As a result, depression is viewed to be caused by a conglomerate of environmental, psychological, biological, and chemical factors. Thus, it is important to note that psychiatry is multidisciplinary and may utilize treatment methods that are not based in neurology.

One such example of a psychiatric treatment method that is not neurologically-founded is psychotherapy, which primarily alleviates the symptoms of mental disorders that are not directly associated with complications in the physical or chemical structure of the brain. Psychotherapy is an opportunity for an individual to learn coping mechanisms for difficult situations and relieve stress that can be amplified by mental illness (Mayo Clinic, 2016). Unlike ECT, the results of psychotherapy are heavily dependent on both the therapist and the patient. According to Per Høglend's "Psychotherapy Research" (1999), an ideal therapist is able to apply psychiatric interventions to their patient and adjust these interventions according to their patient's response. A suitable patient is one that can verbalize their concerns and work well with others. The efficacy of psychotherapy is, therefore, highly contingent on the individuals involved. On average, 63 out of 100 individuals who continually participate in psychotherapy have seen progress with their psychiatric disorder, while only 38 out of 100 individuals under a placebo or minimal treatment experienced the same effect (Høglend, 1999). This indicates that 25 out of 100 people who undergo psychotherapy report a successful outcome.

The effectiveness of common psychiatric disorder treatments, ECT, medication, and psychotherapy, vary among individuals. Both neurologically and non-neurologically-based treatments have their benefits. In general, there is no large discrepancy between the effectiveness of medication and psychotherapy usage surrounding patients with moderate anxiety or depressive disorders, as seen in a study conducted by Alvine Fansi (2015). Despite this, psychotherapy seems to have longer positive effects with a reduced likelihood of relapse (Fansi 2015). According to a study led by Pim Cuijpers (2013), a similar pattern is seen in patients with panic disorder and seasonal affective disorder (seasonal depression), where the effectiveness of psychotherapy and medication parallel each other. A shift occurs with dysthymia, a severe form of chronic depression that is more effectively treated with medication than psychotherapy, and obsessive-compulsive disorder (OCD), a disorder that is more effectively treated with psychotherapy than medication (Cuijpers et al., 2013). ECT is often used as a last resort, to treat disorders that have not been improved by treatments that have lower risk and are easier to access. As demonstrated in a study led by Eric Ross (2018), ECT, in comparison to medication and psychotherapy, is more effective in treating severe depression, but has extremely high relapse rates. There is potential evidence to suggest that the relapse rates and, thus, effectiveness of ECT may

improve when ECT treatment is coupled with medication (Youssef & McCall, 2014) or psychotherapy (McClintock et al., 2011), specifically in treating severe depression. Still, further investigation is required to solidify this evidence, as it originated from studies with flawed designs that require refining. Overall, all treatments of psychiatric disorders are helpful in mediating their symptoms, but their effectiveness depends on the individual and their mental illness. Thus, it is important to note that psychiatry is multifaceted. The incorporation of neurological methods in the treatment of psychiatric disorders has proven to be effective for many, but it is overly simplistic to rely solely on medication or ECT as treatment when addressing a disorder that can be better alleviated with psychotherapy or a combination of psychotherapy, medication, and ECT.

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