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One of the largest social issues of the 20th and 21st centuries has been sexual equality, specifically in the professional world. Whether it is the difference observed in wages earned compared to men and women or the population distribution in the workplace based on sex, there is a clear trend of male dominance. Large advances have been made to combat the divide over the past 20 years alone, but the progressive movement is far from over. The sciences specifically have been plagued by sexual inequality, but social progress has slowly infiltrated the field. Neuroscience, defined broadly as the study of the nervous system, is a relatively young discipline, but regardless has strong divisions in gender equality. Its brief history has given it a flexible structural advantage, and a large number of notable women have arisen to prominence, as a result. Although the field today is still predominantly male, countless advances are credited to the ingenuity and discipline of female neuroscientists. Helen S. Mayberg is a predominant neuroscientist who has devoted her studies to depression. She has made incredible advances towards treating the mental disorder, which is considered the most common of psychiatric disorders (1). Mayberg is a prime example of how even though she is placed at a disadvantage created by society, she, and all women, have a defining role in directing the future, specifically in Mayberg's case, in the field of neuroscience. Mayberg has made extensive progress in working with depression and developing Deep Brain Stimulation (DBS) as a highly successful treatment, revolutionizing the future of psychiatric treatment.

Depression is an extremely common disorder, which is categorized, but not limited to dark and sad emotional thoughts, feelings of emptiness and a bleak outlook (2). Kandel, a Nobel Prize winning neuropsychiatrist, noted two major regions of the brain that are at least partially responsible for depression, Subcallosal Cingulate Region 25 (Cg25) and the Right Anterior Insula (3). Cg25 is known to modulate sadness and negative mood states (4) while the Right Anterior Insula is responsible for feelings of self-awareness and the interpersonal experience (3). These two regions of the brain connect with the

hypothalamus, amygdala, hippocampus and prefrontal cortex, forming a complex and highly involved neural network. Depression disorders can disturb a wide array of regions in the brain (3). Depression inevitably affects these individual regions to variable degrees, the strongest degree being called resistant depression. The current trend in the field of depression studies, also those pursued by Mayberg, is investigating resistant depression, which fails to respond to at least four different types of treatments, including the use of antidepressant prescriptions (2). Mayberg's work focuses on examining and developing a practical cure for resistant depression, a widespread and unsolved disorder within the current global population.

Mayberg began her pursuit in neuroscience and focus on depression through her college career, which carried her up through the ranks of higher education. She began studying psychobiology at the University of California, Los Angeles where she earned her undergraduate degree. She attended medical school at the University of Southern California, and currently is researching and teaching out of the Emory University School of Medicine (5). She has established a world-renowned Depression Research Program which has a primary focus of developing "imaging and physiological based algorithms to discriminate depressed subgroups and optimize treatment at all stages" (5). Mayberg has gained an international reputation for her commitment to understanding and treating depression.

Mayberg's early work was focused on identifying the culprit regions, the previously noted Cg25 and Right Anterior Insula. Mayberg used blood flow rates going to and from target regions in the brain to analyze the region activity levels. She noted that in individuals with depression and feelings of sadness, there was an increase in blood flow between Cg25 and the Right Anterior Insula, along with a decrease in flow between Cg25 and the neocortical regions (6). The opposite trend was observed in individuals who were undergoing successful recovery of depression, leading to the confirmation of reversible regional interactions through networks responsible for mediating moods (3). The discovery of these neural networks led Mayberg to question how to approach cases of depression that are more complicated and fail to respond to prescription antidepressants.

After of few years of focusing in on the networks responsible for depression, Mayberg had developed and refined the highly effective and cutting-edge process known as Deep Brain Stimulation (DBS) in 2005. The concept was modified after the treatment of Parkinson's disease, by applying electrical current to modify neuron activity in select regions (2). Mayberg was able to modify depression-based moods through a series of electrode implants, comparable to a "pacemaker for the depressed brain" (7). Mayberg developed a clinical trial, where 8 electrodes were placed in the brain, targeting the Cg25 region of depressed individuals. These electrodes received electric stimulations on average of 4.0 volts at 130Hz lasting 60 microseconds (2). Immediate short term testing resulted in the individuals experiencing "Calmness", "Brightening" and intensified colors, without any sensory or motor phenomena (2). The treatment was able to dissolve depression symptoms; Long term testing provided positive recovery results including those caused by placebo effects. Patients were unable to detect the stimulus but were under the impression that stimuli were frequently occurring over an extended sixth month period. Four of the patients (66%) maintained the antidepressant response after six months, including three of who experienced remission (2). Mayberg had pioneered not only a short-term approach for treating resistant depression, but also one that had a long term potential for remission. The new method received a warm welcome from the scientific community, as a highly effective approach to managing the most common psychiatric disorder had been discovered, but it also promised potential application as a treatment tool for other disorders.

Mayberg's development and treatment of depression through DBS are clearly a huge advancement in the field of neuroscience. DBS is being evaluated by medical groups around the world as a common treatment option used to combat widespread depression. It is also being applied to other pressing neurological disorders such as anorexia, substance abuse and addiction (8). DBS has endless possibilities for treating all types of disorders caused by neurological activity in the brain. Mayberg's work has led to one of the largest breakthroughs in treating mental disorders of the 21st century. Her crucial advancement speaks to the undervalued role of women within science, as she has opened up a whole new series of possibilities in neuroscience alone, with countless possible applications and adaptations in the future of the medical field. Mayberg illustrates the

power of an individual, regardless of sex, race or any other classification. As the 21st century continues to bring new advancements and innovations, women will undoubtedly make rapid gains in equality, as they will earn the respect of their colleagues through their determination. Never underestimate the power of a socially defined minority; one never knows how they may influence outcomes of the future.

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