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Mathematical modeling of obsessive compulsive disorder

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We all at some point become fixated with certain actions or ideas. However, for the two to three percent of the world population with obsessive compulsive disorder (OCD), these fixations become so intense that the individual is debilitated. The exact obsessions the patients experience vary from case to case, but most obsessions fall within five categories: contamination, hoarding, ordering / symmetry, religious, and danger. Sufferers of OCD usually recognize that their obsessions are unreasonable and illogical, yet are unable to prevent them. To alleviate these obsessions, the patients perform compulsions or ritualistic acts. Functional imaging studies have consistently implicated the caudate nucleus, the anterior cingulate gyrus, and the orbitofrontal cortex as the major causes of OCD. All three parts of the brain show hyperactivity in OCD patients and decreased activity of patients post treatment. The caudate nucleus is a part of the basal ganglia and is connected to the neocortex through a series of thalamocortical loops. These loops start in certain parts of the neocortex, such as the anterior cingulate gyrus and the orbitofrontal cortex, and run through the basal ganglia to the thalamus and then back to the neocortex. OCD patients appear to become stuck in one of these loops. In an attempt to better understand the loops, a mathematical model is being constructed to represent the OCD network pathway. General NEural SIMulation System (GENESIS) is a computer program being employed in the construction of the network. Currently, the framework for the OCD model has been constructed. This model will be enhanced in the coming months to create a more biologically realistic model. We hope to be able to show the reoccurring loop of OCD patients. Ultimately, a better understanding of the thalamocortical loop may lead to better treatment of OCD.