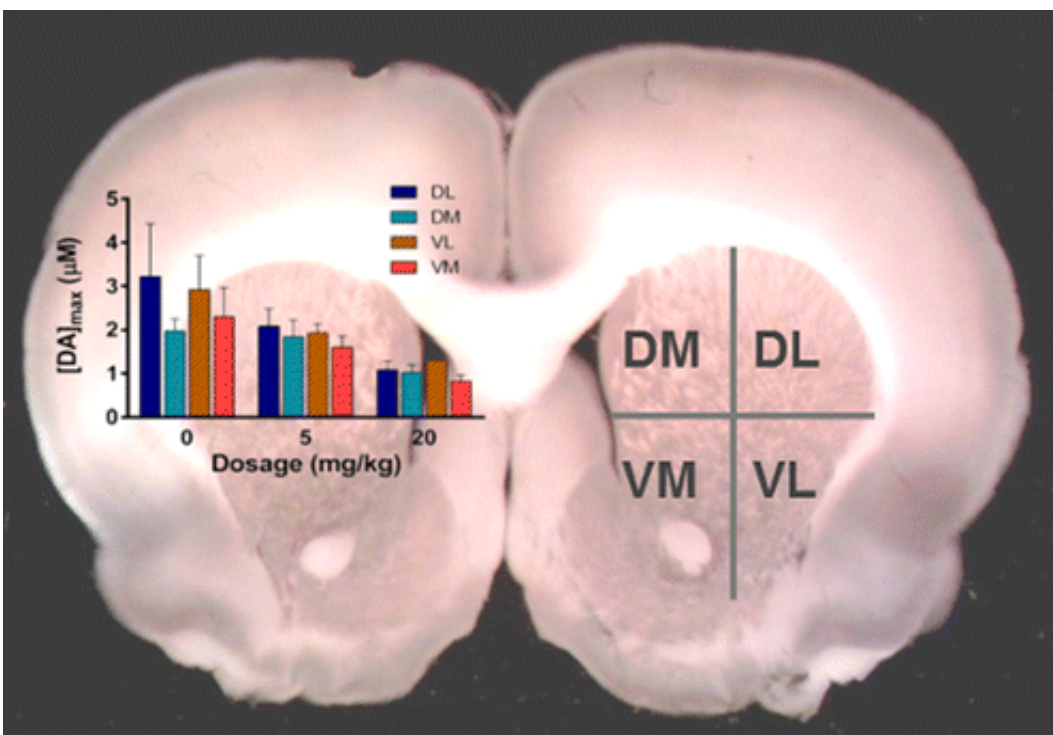


# Investigating how 'chemo brain' develops in cancer patients

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Credit: American Chemical Society

During and after chemotherapy, many cancer patients describe feeling a mental fog, a condition that has been dubbed "chemo brain." Why this happens is unclear, but researchers have found a new clue to understanding this syndrome. A study in the journal *ACS Chemical Neuroscience* reports that chemotherapy in rats affects their chemical messengers dopamine and serotonin, which are associated with

cognition.

Studies have estimated that up to one-third of [chemotherapy patients](#) experience a change in their cognitive abilities. The complication can include memory lapses, trouble concentrating and difficulty remembering common words. Scientists have proposed that the [chemotherapy drugs](#) could cause the symptoms by restricting blood flow in the brain or interfering with chemical signaling. Michael A. Johnson and colleagues at the University of Kansas wanted to investigate how carboplatin therapy—commonly given to patients with breast, bladder, colon and other cancers—affects dopamine and serotonin.

The researchers administered carboplatin to rats over four weeks and found that the release and uptake of both dopamine and serotonin in their brains became sluggish after treatment. Also, the treated rats appeared to have cognitive issues. The results suggest that impaired neurotransmitter release and uptake could play a role in the development of [chemo brain](#), although more work is needed to further pin down the mechanism, the researchers say.

**More information:** Sam V. Kaplan et al. Impaired Brain Dopamine and Serotonin Release and Uptake in Wistar Rats Following Treatment with Carboplatin, *ACS Chemical Neuroscience* (2016). [DOI: 10.1021/acscchemneuro.5b00029](#)

### **Abstract**

Chemotherapy-induced cognitive impairment, known also as "chemobrain", is a medical complication of cancer treatment that is characterized by a general decline in cognition affecting visual and verbal memory, attention, complex problem solving skills, and motor function. It is estimated that one-third of patients who undergo chemotherapy treatment will experience cognitive impairment. Alterations in the release and uptake of dopamine and serotonin, central

nervous system neurotransmitters that play important roles in cognition, could potentially contribute to impaired intellectual performance in those impacted by chemobrain. To investigate how chemotherapy treatment affects these systems, fast-scan cyclic voltammetry (FSCV) at carbon-fiber microelectrodes was used to measure dopamine and serotonin release and uptake in coronal brain slices containing the striatum and dorsal raphe nucleus, respectively. Measurements were taken from rats treated weekly with selected doses of carboplatin and from control rats treated with saline. Modeling the stimulated dopamine release plots revealed an impairment of dopamine release per stimulus pulse (80% of saline control at 5 mg/kg and 58% at 20 mg/kg) after 4 weeks of carboplatin treatment. Moreover,  $V_{max}$ , the maximum uptake rate of dopamine, was also decreased (55% of saline control at 5 mg/kg and 57% at 20 mg/kg). Nevertheless, overall dopamine content, measured in striatal brain lysates by high performance liquid chromatography, and reserve pool dopamine, measured by FSCV after pharmacological manipulation, did not significantly change, suggesting that chemotherapy treatment selectively impairs the dopamine release and uptake processes. Similarly, serotonin release upon electrical stimulation was impaired (45% of saline control at 20 mg/kg). Measurements of spatial learning discrimination were taken throughout the treatment period and carboplatin was found to alter cognition. These studies support the need for additional neurochemical and behavioral analyses to identify the underlying mechanisms of chemotherapy-induced cognitive disorders.

Provided by American Chemical Society

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