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Miller School Researcher Links Algae Blooms to Airborne Neurotoxins

Neurotoxins from blue-green algae blooms can travel through the air, posing potential health risks when inhaled, according to a groundbreaking study by a University of Miami Miller School of Medicine researcher.

David A. Davis, Ph.D.

“This is the first time that airborne cyanobacteria toxins have been found in human olfactory specimens,” said David A. Davis, Ph.D., research assistant professor of neurology and associate director of University of Miami Brain Endowment Bank. “This is an important health issue, as these toxins have been linked to cognitive and neurodegenerative conditions such as Alzheimer’s or Parkinson’s disease.”

Dr. Davis was the lead author of the study, “Detection of Beta-N-methylamino-L-alanine [BMAA] in Postmortem Olfactory Bulbs of Alzheimer’s Disease Patients Using UHPLC-MS/MS: An Autopsy Case-Series Study,” published recently in *Toxicology Reports.*

Cyanobacteria from algae blooms produce toxins that can damage the brain, liver, kidneys, or other organs, said Dr. Davis. He added that algae blooms in warm, slow-moving, nutrient-laden bodies of water are a major environmental problem in Florida, as they produce foul odors and taste compounds, as well as

health risks.

Toxin Found in Nasal Passages

In previous studies, Dr. Davis found high levels of dangerous neurotoxins in brains of marine animals that ate fish infected with cyanobacterial toxins. Now, he has found BMAA – a cyanobacterial toxin linked to neurodegenerative disease – in the nasal passages of six autopsied South Floridians who had lived near bodies of fresh water for a decade or longer. “We tested samples of the olfactory bulbs, the smelling sensors in the nose, and found neurotoxins in every individual,” he said.

“Our study shows individuals could be affected by airborne BMAA particles, as well as by eating certain types of seafood that may contain cyanobacterial toxins,” said Dr. Davis, adding that environmental researchers have previously detected BMAA in air samples collected near active cyanobacterial blooms and on home air conditioning filters.

“It appears that these airborne bacteria can travel an extended distance from the algae bloom, although the levels of toxins decrease with distance,” said Dr. Davis, who collaborated with Miller School co-authors Susanna P. Garamszegi, manager of the research laboratory, and Linda L. Duque, research associate.

Because toxic compounds absorbed into the olfactory bulbs can gain direct access to the brain, exposure to aerosols from cyanobacteria should be carefully monitored, especially in susceptible and vulnerable populations, according to Dr. Davis. “We don’t know the clinical significance of these findings, but tissues in individuals with the highest levels of the toxin also showed increased signs of inflammation and

olfactory tract degeneration," he said.

Noting that the new study raises a number of questions, Dr. Davis said he plans to look more closely at the nasal pathway to see how neurotoxins may be carried deeper into the brain, and if there is a way to slow or halt the movement. "Olfactory dysfunction can reduce an individual's quality of life, cause depression, and be an early symptom of cognitive impairment," he said. "In any case, further research is needed to evaluate BMAA's toxicity via airborne exposure and any factors that might increase an individual's susceptibility or resiliency."

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