St. Michael's reports second known case of patient developing synesthesia after brain injury

July 30 2013

About nine months after suffering a stroke, the patient noticed that words written in a certain shade of blue evoked a strong feeling of disgust. Yellow was only slightly better. Raspberries, which he never used to eat very often, now tasted like blue – and blue tasted like raspberries.

High-pitched brass instruments—specifically the brass theme from James Bond movies—elicited feelings of ecstasy and light blue flashes in his peripheral vision and caused large parts of his brain to light up on an MRI. Music played by a euphonium, a tenor-pitched brass instrument, shut down those sensations.

The patient said he was initially frightened by the mixed messages his brain was sending him and the conflicting senses he was experiencing. He was so worried that something was seriously wrong with him that he raised it with a nurse only as he was leaving an appointment at St. Michael's Hospital in downtown Toronto.

Physicians and researchers immediately recognized he had synesthesia, a neurological condition in which people experience more than one sense at the same time. They may "see" words or numbers as colours, hear sounds in response to smells or feel something in response to sight.

Most synesthetes are born with the condition, and include some of the

world's most famous authors and artists, including author Vladimir Nabakov, composer Franz Liszt, painter Vasily Kandinsky and singer-songwriter Billy Joel.

The Toronto patient is only the second known person to have acquired synesthesia as a result of a brain injury, in this case a stroke. His case was described in the August issue of the journal *Neurology* by Dr. Tom Schweizer, a neuroscientist and director of the Neuroscience Research Program at St. Michael's Li Ka Shing Knowledge Institute.

Dr. Schweizer examined the patient's brain activity in a functional MRI and compared it to six men of similar age (45) and education (18 years) as each listened to the James Bond Theme and a euphonium solo.

When the James Bond Theme was played, large areas of the patient's brain lit up including the thalamus (the brain's information switchboard), the hippocampus (which deals with memory and spatial navigation) and the auditory cortex (which processes sound).

"The areas of the brain that lit up when he heard the James Bond Theme are completely different from the areas we would expect to see light up when people listen to music," Dr. Schweizer said. "Huge areas on both sides of the brain were activated that were not activated when he listened to other music or other auditory stimuli and were not activated in the control group."

The patient and members of the control group also viewed 10-second blocks of words presented in black (which elicits no emotional response in the patient), yellow (mild disgust response) and blue (intense disgust response).

Reading blue letters produced extensive activity in the parts of the patient's brain responsible for sensory information and processing

emotional stimuli and similar but less intense responses for yellow letters. Control groups showed no heightened brain activity in response to the different coloured letters.

Dr. Schweizer said the fact that the patient had very targeted and specific responses to certain stimuli – and that these responses were not experienced by the control group – suggests that his synesthesia was caused as his brain tried to repair itself after his stroke and got cross-wired.

The patient's stroke occurred in the thalamus, the brain's central relay station. That's the same part of the brain affected by the only other reported case of acquired synesthesia.

Provided by St. Michael's Hospital