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FROM THE THALAMUS WITH LOVE: A RARE WINDOW INTO THE LOCUS OF EMOTIONAL SYNESTHESIA

Emotional synesthesia is a condition in which specific sensory stimuli are consistently and involuntarily associated with emotional responses.¹ There is a very small number of reports of subjects with these stereotyped emotion-sensation pairings. One report described a subject in whom tactile stimulation from different textures (e.g., denim) elicited affective experiences (e.g., feelings of depression).² Others have described emotional synesthetic associations to grapheme-color perceptions³ and to written names of acquaintances.¹ Because there is such a small amount of literature, all in normal subjects with long histories of synesthesia, the neural substrates are unknown. There is a single report of acquired synesthesia: a tingling sensation elicited by sounds, but without emotional synesthesia, after a thalamic infarction.⁴ We report on the only known case of acquired emotional synesthesia after a focal thalamic lesion, providing a possible window into the neural substrate of this condition.

Case. The patient was a 45-year-old right-handed man with 18 years of education and a history of hypertension. He experienced a small left posterolateral thalamic hemorrhage including portions of the pulvinar, lateral posterior, posterior, and ventral posterior lateral nuclei with possible extensions into the internal capsule (see reference 5 for clinical information). Nine months after his stroke, he first reported 2 intense sensory-emotional experiences. High-pitched brass instruments (specifically, the brass theme from James Bond movies), in addition to eliciting an extracorporeal sensation described as “riding the music,” also elicited feelings of ecstasy—which he described as “orgasmic”—along with light blue photisms in his periphery. Additionally, words written in blue typeface were associated with subjective strong feelings of disgust; words written in yellow elicited a milder disgust response.

Methods. Potential neural correlates of his subjective experiences were examined 18 months poststroke in a series of functional MRI (fMRI) studies in which his responses were compared with those of 6 age- and education-matched neurologically healthy control

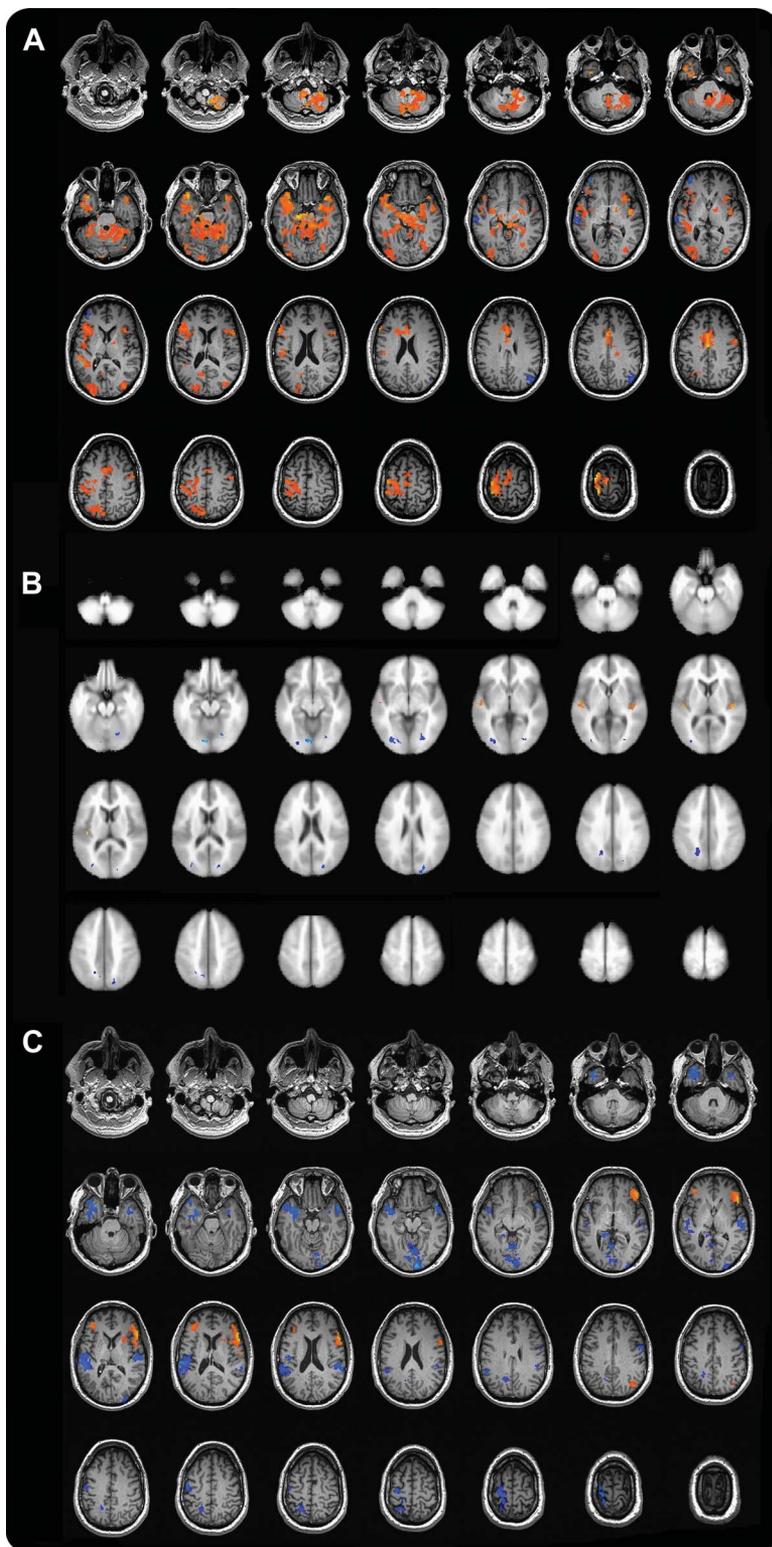
participants. All participants completed an fMRI experiment contrasting responses to synesthetic elicitors (the Bond theme) with acoustically similar stimuli that did not elicit emotions (euphonium solo).

Results. Contrast analyses for our patient, but not controls, showed greater neural responses to the Bond theme in a widely distributed neural network including the auditory cortex, somatosensory cortex, motor cortex, left dorsal insula, thalamus, hippocampus, right paramedian cerebellum, left ventrolateral prefrontal cortex, lateral occipital (left > right), and midline frontal regions (see figure, A and B). Importantly, this distributed activity differs from the reward circuit identified in studies of music perception and is consistent with the patient’s reports that the music produces intense emotional arousal rather than simply being a pleasant musical experience.

All participants also viewed 10-second blocks of words presented in black (which does not elicit an emotional response in our patient), yellow (mild disgust response), and blue (intense disgust response). In our patient, the blue minus black contrast produced extensive activity in left striate and extrastriate regions (suggesting increased sensory and attentional processing of emotional stimuli by those regions, potentially mediated by the pulvinar⁶), motor cortex, anterior insula, cerebellum, and midline prefrontal cortex. Similar, but attenuated, patterns of activity were found for the yellow minus black contrast, suggesting that his reactions to the stimuli were graded, consistent with his reported subjective emotional experiences. Control participants showed no difference across the stimulus types.

Discussion. Synesthetic experiences involving emotion are quite rare. Single cases have included a patient with tactile-emotion associations² as well as a patient who associated colors with an emotional feeling toward other individuals. It is much more common for synesthetes to feel an emotion when presented with stimuli that do not match their anomalous emotional associations. For example, a word color-photism patient who usually sees the word “cat” as being green would experience negative affect—often a feeling of “wrongness”—if shown “cat” written in a different color.³ This feeling, although technically an emotion, is vastly different

Figure fMRI brain activation patterns of our patient and controls



(A) Functional MRI (fMRI) results depicting activity from the “James Bond theme–euphonium” contrast analysis. (B) Activity for the identical analysis with 6 healthy controls, normalized onto a Talairach template. (C) fMRI activity in response to the James Bond theme when our patient was instructed to suppress his emotional synesthesia experiences.

from the intense emotional experiences felt by our patient.

The patient also reported that he was able to suppress his synesthesia—an ability not present in developmental synesthetes. In an fMRI study contrasting normal perception of the Bond theme with active suppression, suppressing responses produced deactivations in auditory cortices (left > right) and robust activation in the right lateral prefrontal cortex, a region associated with inhibition and response control⁷ (figure, C).

Developmental synesthesia is uncommon, with developmental emotional synesthesia less common still. Acquired synesthesias are even more rare. The fact that the 2 reported cases of acquired synesthesia had thalamic damage suggests that aberrant neuroplasticity in the densely packed thalamic pathways—between sensory projection pathways or between sensory and limbic pathways—may be a common mechanism that could have implications for understanding the developmental forms of synesthesia.

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