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Music in the brain: The first imaging genetic study linking dopaminergic genes to music

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Sounds, such as music and noise, are capable of reliably affecting individuals' moods and emotions, possibly by regulating brain dopamine, a neurotransmitter strongly involved in emotional behavior and mood regulation.

However, the relationship of sound environments with mood and emotions is highly variable across individuals. A putative source of variability is genetic background.

In this regard, a new imaging genetics study directed by Professor Elvira Brattico from Aarhus University and conducted in two Italian hospitals in collaboration with the University of Helsinki (Finland) has provided the first evidence that the effects of music and noise on affective behavior and brain physiology are associated with genetically determined dopamine functionality.

In particular, this study, published in the journal *Neuroscience*, revealed that a functional variation in dopamine D2 receptor gene (DRD2 rs1076560) modulates the impact of music as opposed to noise on mood states and emotion-related prefrontal and striatal brain activity, evidencing a differential susceptibility for the affect-modulatory effects of music and noise on the GG and GT genotypes.

In more details, results showed mood improvement after music exposure in GG subjects and mood deterioration after noise exposure in GT subjects. Moreover, the music as opposed to noise environment

decreased the striatal activity of GT subjects as well as the prefrontal activity of GG subjects while processing emotional faces.

These results are novel in identifying a biological source of variability in the impact of sound environments on emotional responses. The first author of the study, Tiziana Quarto, Ph.D. student at University of Helsinki under supervision of Prof. Brattico, further comments:

"Our approach allowed the observation of the link between genes and phenotypes via a true biological path that goes from functional genetic variations (for which the effects on molecular function is known) to brain physiology subtending behavior. The use of this approach is especially important when the investigated behavior is complex and very variable across subjects, because this means that many biological factors are involved".

"This study represents the first use of the imaging genetics approach in the field of music and sounds in general. We are really excited about our results because they suggest that even a non-pharmacological intervention such as music, might regulate mood and emotional responses at both the behavioral and neuronal level," says Professor Elvira Brattico.

"More importantly, these findings encourage the search for personalized music-based interventions for the treatment of brain disorders associated with aberrant dopaminergic neurotransmission as well as abnormal mood and emotion-related brain activity".

More information: T. Quarto et al, Interaction between DRD2 variation and sound environment on mood and emotion-related brain activity, *Neuroscience* (2017). DOI: 10.1016/j.neuroscience.2016.11.010