Structural and functional changes in human brain with musical training

Background: A number of researchers have reported that learning to play a musical instrument shapes the healthy human brain, not only in children, but also in adults {REF]. Gaser and Schlaug (2003), found that the grey matter volume in motor, auditory, and visual–spatial brain regions was different in musicians who practise at least one hour per day compared with non-musician. We therefore conducted a longitudinal study with repeatedly measured structural and functional MRI while participants were taught a new musical skill. The overall aim of this project is to quantify the time course of these changes by observing the brain structure such as white and grey matter volume, and brain activity using functional MRI.

Methods: Fifteen participants were trained to play the drum kit for six months. Three sets of high resolution structural (T1-weighted) and functional (BOLD T2*) were acquired before training sessions began, during, and after training using a 3T MRI scanner. Then voxel based morphometry (VBM) was used to analyse the T1 images and Statistical Parametric Mapping (SPM12) was used to quantify functional brain activation data while participants were asked to categorised drumming patterns.

Results: Structural brain imaging showed bilateral significant changes in the white matter volume at the junction between cuneus, precuneus, superior parietal lobule ($p<0.05$ and $K = 12$ left, $p<0.05$ and $K = 11$ right Cerebrum) . Functional brain imaging showed that bilateral activation changes in superior temporal gyrus ($p<0.05$ and $K= 671$), middle occipital gyrus ($p<0.05$ and $K= 490$) and insula ($p<0.05$ and $K= 282$).

Conclusion: We show changes in white matter volume and functional activation changes as a result of long term training. Our results suggest that the structural specialisation seen in musicians is the result of learning rather than genetic predisposition.