



Letter to the Editors

Functional magnetic resonance imaging examination of the magnocellular visual pathway in nonpsychotic relatives of persons with schizophrenia

Dear Editors,

Research in humans and primates has identified two physiological subsystems in the visual system (Livingstone and Hubel, 1987). The magnocellular (M) visual pathway is responsible for processing location information and motion, while the parvocellular (P) visual pathway is responsible for processing detail and color. Psychophysical studies in persons with schizophrenia and their healthy relatives have revealed that the M pathway appears dysfunctional, while the P pathway appears relatively preserved (e.g., Brenner et al., 2003; Chen et al., 1999; Green et al., 1997).

Few physiological studies have examined M pathway functioning in schizophrenia. Three studies using electroencephalography (EEG) reported reduced signal amplitude in posterior cortical regions along the M pathway in persons with schizophrenia, with normal activation in the P pathway (Butler et al., 2001; Doniger et al., 2002; Foxe et al., 2001). One study used functional magnetic resonance imaging (fMRI) and reported hypoactivation of the M pathway (particularly in the right hemisphere) in persons with schizophrenia, but no evidence of abnormal functioning in the P pathway (Braus et al., 2002). There do not appear to be published studies specifically examining the magnitude of M pathway functioning using physiological methods in relatives of persons with schizophrenia, which would provide support for genetic contributions in M pathway dysfunction.

We used fMRI (1.5 T) to examine M pathway functioning in 13 nonpsychotic first-degree relatives and 11 controls. The groups did not significantly differ

on age, gender, or visual acuity. Cortical localization of the M pathway was assessed by targeting a specific region of cortex (V5/MT) well established as a primary center along the M pathway (e.g., Ahlfors et al., 1999). During scanning, participants viewed a display that projected nine concentric black rings on a green background. During the movement condition, rings were presented sequentially (5 Hz), creating the illusion of a single ring expanding or contracting for a block length of 21.6 s. This was followed by all nine rings appearing simultaneously and stationary for 21.6 s. Blocks alternated eight times over two separate fMRI scanning runs.

A statistical contrast of fMRI signal strength in bilateral cortical region V5 during blocks of moving, relative to stationary, rings was conducted. V5 was defined bilaterally based on average location and variation from previous neuroimaging studies (e.g., Watson et al., 1993), using an initial 18-mm sphere centered on Talairach coordinates $\pm 40, -70, 3$. A new sphere of 10 mm was then centered on the most significant voxel in this region. All statistically significant voxels in each bilateral 10-mm sphere were considered V5. Relatives did not differ from controls in V5 signal strength when averaged across the two hemispheres (Table 1). However, when lateralized effects were examined, relatives showed weaker signal strength in right hemisphere V5, relative to bilateral V5, which was limited to the percent intensity change (PIC) measure. This proportional lateralized effect appears to be driven by a statistical trend toward reduction in PIC in right hemisphere (non-proportional) V5 in the relatives, $t(22) = 1.71, p = 0.10$, as the PIC measure from left hemisphere (non-proportional) V5 showed no suggestion of difference between the groups, $t(22) = 0.49, p = 0.63$.

Results are consistent with previous physiological reports of a hypoactive M pathway in schizophrenia, but extend findings to provide evidence of a deficit in

Table 1
Group comparisons on fMRI measures of V5 activation

fMRI measure	Controls	Relatives	Statistic	<i>p</i>
Bilateral <i>t</i> -score ^a	4.45±1.45	3.89±1.09	<i>U</i> =51.0	0.24
Bilateral PIC ^b score	0.62±0.18	0.54±0.13	<i>t</i> =1.26	0.22
Bilateral volume ^c	720±234	596±297	<i>U</i> =60.0	0.51
Right hemispheric proportion ^d for <i>t</i> -score	48.7±4.65%	48.4±10.5%	<i>t</i> =0.12	0.91
Right hemispheric proportion ^d for PIC	50.0±6.72%	45.8±8.81%	<i>U</i> =38.0	0.05
Right hemispheric proportion ^d for volume	45.2±18.7%	47.5±28.1%	<i>U</i> =69.5	0.91

^aAverage *t*-score value from cluster of contiguous significant voxels in V5.

^bPIC=Average percent intensity change in fMRI signal from cluster of contiguous significant voxels in V5.

^cRight hemispheric proportion=value in right hemisphere divided by sum of values from both hemispheres.

^dVolume= Number of contiguous significant 2×2×2 mm voxels (size of voxels after normalization procedure).

first-degree relatives. Results suggest the effect may be more robust in the right hemisphere. This finding needs to be interpreted with caution, as the effect appears to be driven by five relatives from a particular family. However, findings suggest that further research is warranted, using similar methodology, to examine persons with schizophrenia and a larger group of relatives.

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