

Research article

Assessing the heritability of attentional networks

Jin Fan^{*1}, Yanhong Wu², John A Fossella¹ and Michael I Posner¹

Address: ¹Sackler Institute, Weill Medical College, Cornell University, New York, USA and ²Department of Psychology, Peking University, Beijing, China

E-mail: Jin Fan* - jif2004@med.cornell.edu; Yanhong Wu - wuyh@pku.edu.cn; John A Fossella - johnfossella@hotmail.com; Michael I Posner - mip2003@med.cornell.edu

*Corresponding author

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Abstract

Background: Current efforts to study the genetics of higher functions have been lacking appropriate phenotypes to describe cognition. One of the problems is that many cognitive concepts for which there is a single word (e.g. attention) have been shown to be related to several anatomical networks. Recently we have developed an Attention Network Test (ANT) that provides a separate measure for each of three anatomically defined attention networks. In this small scale study, we ran 26 pairs of MZ and DZ twins in an effort to determine if any of these networks show sufficient evidence of heritability to warrant further exploration of their genetic basis.

Results: The efficiency of the executive attention network, that mediates stimulus and response conflict, shows sufficient heritability to warrant further study. Alerting and overall reaction time show some evidence for heritability and in our study the orienting network shows no evidence of heritability.

Conclusions: These results suggest that genetic variation contributes to normal individual differences in higher order executive attention involving dopamine rich frontal areas including the anterior cingulate. At least the executive portion of the ANT may serve as a valid endophenotype for larger twin studies and subsequent molecular genetic analysis in normal subject populations.

Background

Attention is a complex cognitive function that involves the coordinated activity of several anatomical networks. The executive attention network, which is primarily located in the dorsolateral prefrontal cortex, is responsible for the selection and manipulation of information. The orienting network, which is primarily located in the parietal lobe, is responsible for the selection of sensory information. The alerting network, which is primarily located in the midline structures of the brain, is responsible for the selection of the appropriate response. The Attention Network Test (ANT) is a computerized test that measures the efficiency of these three attention networks. In this study, we used the ANT to measure the efficiency of the executive attention network in 26 pairs of MZ and DZ twins. The results showed that the efficiency of the executive attention network was significantly higher in MZ twins than in DZ twins, suggesting that genetic variation contributes to normal individual differences in executive attention.

1. Introduction

2. Methods

3. Results

4. Discussion

5. Conclusion

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Procedure

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