



# Is frontoamygdalar connectivity in the resting brain linked with externalising behaviours during development?

*By Dr. Jessica Edwards*

Externalising problems tend to vary over the course of development, but often peak in late adolescence.<sup>1</sup> Data suggest that the frontoamygdalar brain circuitry (involved in emotion regulation) might have an important role in mediating externalising behaviour.<sup>2</sup> Indeed, studies involving clinical samples and using task-based approaches have found decreased frontoamygdalar functional connectivity in those exhibiting externalising behaviours.<sup>3,4</sup>

Less is known about how the frontoamygdalar circuitry functions when the brain is at rest and how resting-state functional connectivity might be associated with externalising behaviour during development in the general population. Researchers in the Netherlands and the USA have started to address this knowledge gap, asking whether externalising behaviour is associated with amygdala-anterior cingulate cortex (ACC) or amygdala-orbitofrontal cortex (OFC) functional connectivity across adolescence and young adulthood in the brain at rest.

Thijssen et al. recruited 111 participants aged 11-23 years old from the general population. Each participant underwent a resting-state fMRI scan every 2 years for up to 6 years. They found that externalising behaviour was associated with increased amygdala-ACC and amygdala-OFC functional connectivity over the course of adolescence and young adulthood. However, they did not find evidence for differential developmental trajectories of amygdala-ACC or amygdala-OFC functional connectivity for different levels of externalising behaviour; both low and high externalisers showed the same pattern of stable or increasing amygdala-ACC and amygdala-OFC co-activation over the study period. For amygdala-ACC functional connectivity, the association with externalising behaviour was mostly explained by the level of externalising behaviour at the start of the study rather than a change in externalising behaviour over time. Meanwhile, the association between externalising behaviour and amygdala-OFC functional connectivity seemed to be driven by within-person changes in externalising behaviour over time.

“These results contrast with task-based fMRI studies, but align with other resting-state functional MRI studies in suggesting that individuals showing higher levels of externalising behaviour show increased frontoamygdalar functional connectivity, perhaps indicating a more vigilant state for neural networks important for emotional processing and control when the brain is at rest”, explains Thijssen. “The differential findings for amygdala-ACC and amygdala-OFC functional connectivity emphasises the differential role of these networks in emotional processing. They also highlight the need to investigate changes in brain function and behaviour using longitudinal data”.

An important limitation of this study is the composition of the study sample. The participants mostly comprised white participants from middle to upper-middle socioeconomic groups. Moreover, only few participants showed clinical levels of externalising behaviour. The researchers hope that future studies that involve larger and more varied samples will shed further light on the neuro-developmental trajectories of externalising behaviour.

### Referring to:

Thijssen, S. et al. (2020), *The longitudinal association between externalizing behavior and frontoamygdalar resting-state functional connectivity in late adolescence and young adulthood*. *J. Child Psychol. Psychiatr.* doi: 10.1111/jcpp.13330.

### References:

- <sup>1</sup> Petersen, I.T. et al. (2015). *Describing and predicting developmental profiles of externalizing problems from childhood to adulthood*. *Dev. Psychopathol.* 27, 791–818. doi: 10.1017/S0954579414000789.
- <sup>2</sup> Romero-Martinez, A. et al. (2019). *The brain resting-state functional connectivity underlying violence proneness: is it a reliable marker for neurocriminology? A systematic review*. *Behav. Sci.* 9, 1–19. doi: 10.3390/bs9010011.
- <sup>3</sup> Marsh, A.A. et al. (2011). *Reduced amygdala-orbitofrontal connectivity during moral judgments in youths with disruptive behavior disorders and psychopathic traits*. *Psychiatry Res.* 194, 279–286. doi: 10.1016/j.psychresns.2011.07.008.
- <sup>4</sup> White, S.F. et al. (2016). *Neural correlates of the propensity for retaliatory behavior in youth with disruptive behavior disorders*. *Am. J. Psychiatry.* 173, 282–290. doi: 10.1176/appi.ajp.2015.15020250.

### Glossary:

**Externalising problems:** maladaptive behaviours which are directed externally towards the environment, such as aggressive or rule-breaking behaviours.